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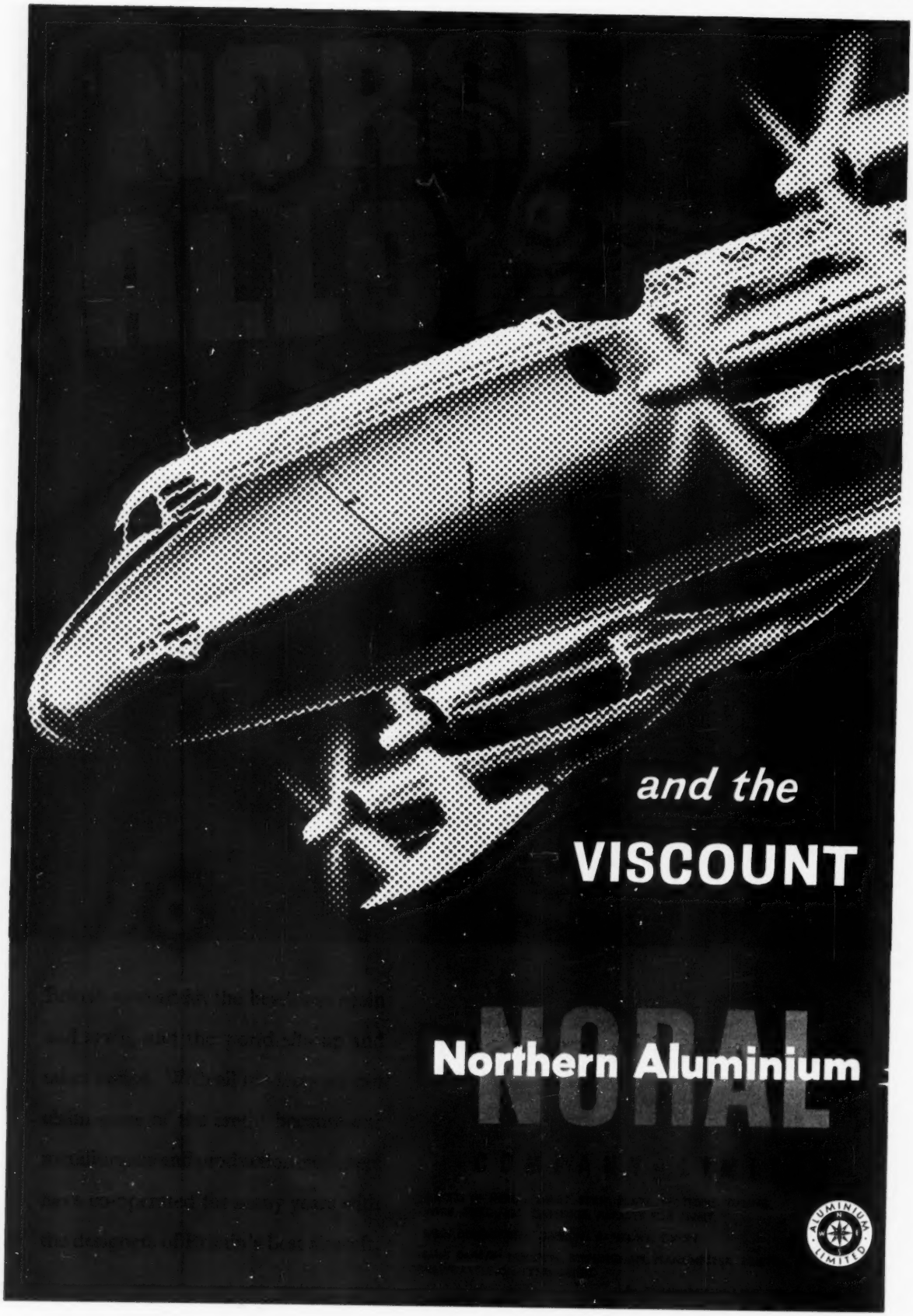
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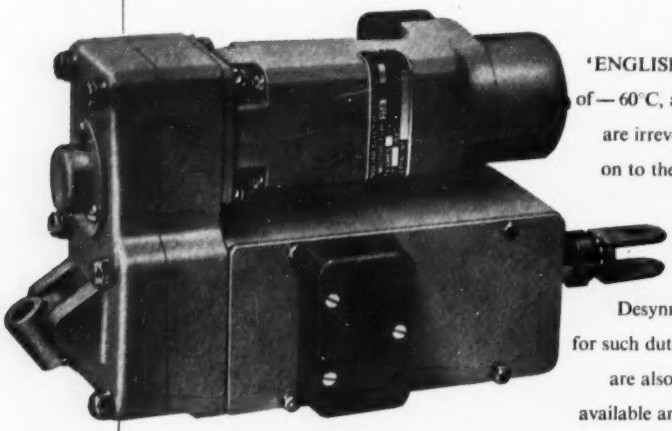

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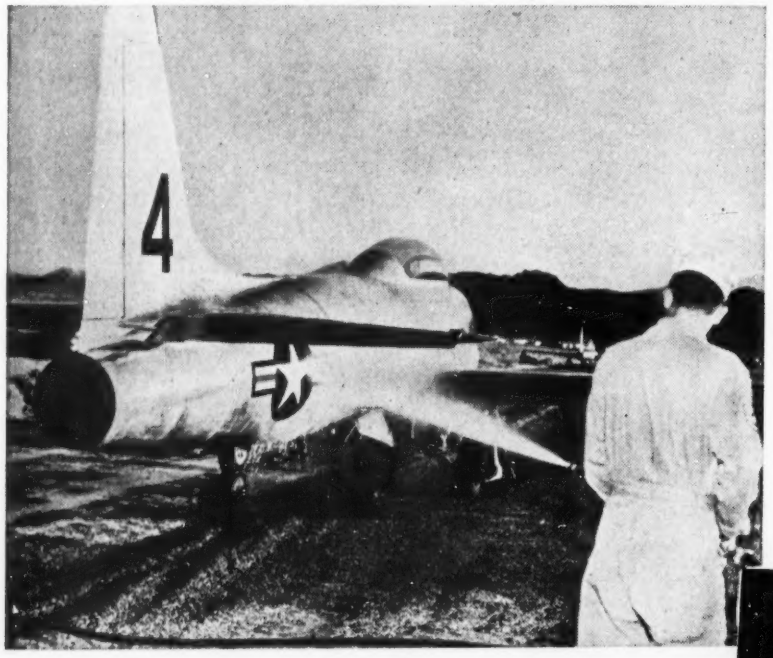

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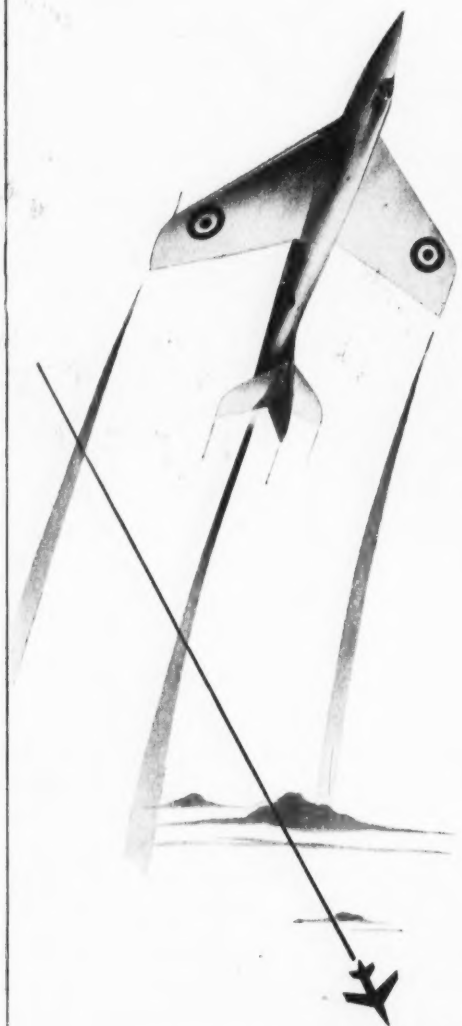

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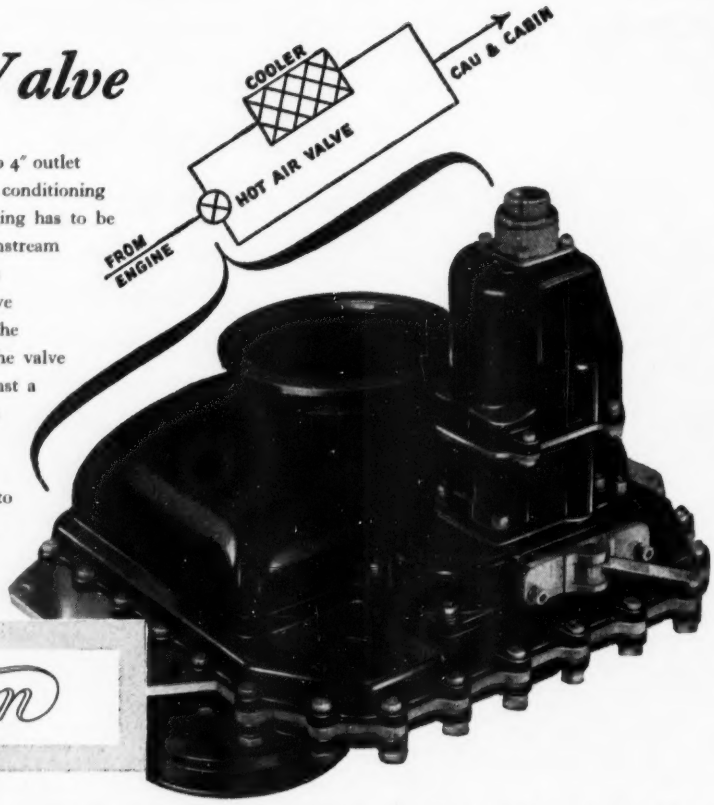

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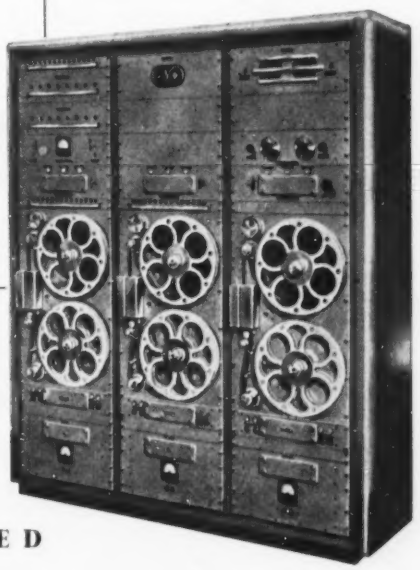

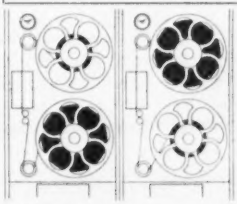

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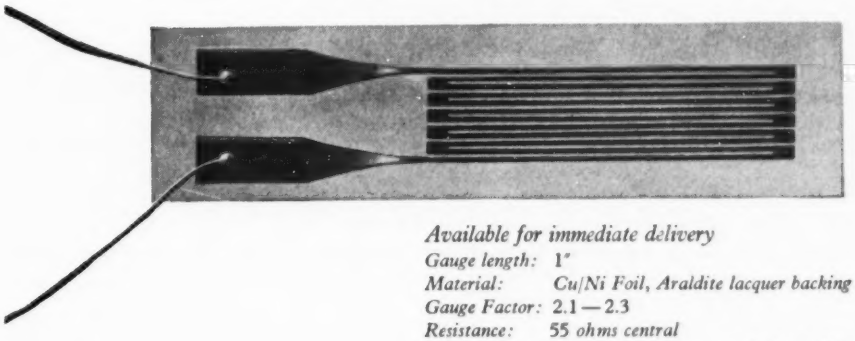

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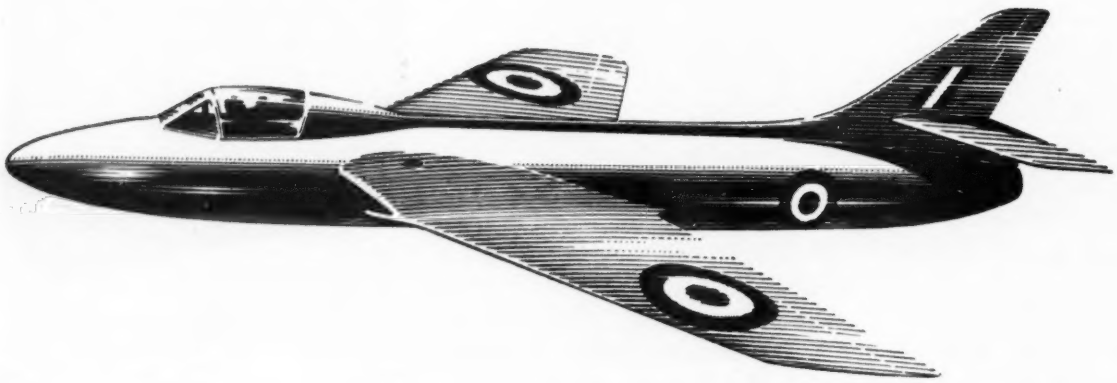

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Wanted—a Bigger Flag

ANY salesman who under-estimates the importance of public opinion makes a great mistake. We are well aware that so far as the aircraft world is concerned the man in the street, or the *homme* in the *rue*, does not make the decision to buy Sabres or Hunters, or even the turbojets to put in them, although it is his money that pays for them. There are, nevertheless, several ways in which he can show his approval or otherwise. Additionally, the foreigner's assessment of many more mundane products may well be coloured by the impressions he forms of, say, the quality and performance of British aircraft.

Since 1945, in aviation matters in particular, the British have become more internationally minded. We have had to. Commercial competition in the civil and military aircraft markets becomes stiffer month by month; yet, paradoxically, our great American rivals are also a great Ally, and at international levels arrangements are made to buy British aircraft with American dollars for European countries. The reasons for this state of affairs are not for discussion here, but such conditions are acceptable to the American businessman, for example, because his order books for aircraft are already full and because it is in our mutual interest to maintain strong Allied Air Forces and widespread production capacity. But underlying all this, as we have remarked, there is still a keen international rivalry, and prestige in aircraft design and production is of immense importance to us.

In just a month's time the French are to stage as a culmination of their aircraft exhibition at Paris an international air display which promises to be one of the most important ever to have been organized. Hundreds of thousands of Frenchmen and thousands of visitors from other countries will be there, not only to see the results of the revival of the French aircraft industry, but also to form impressions of the (to them) foreign aircraft chosen to re-equip many of their squadrons.

One gathers from announcements that French, American and Swedish fighters will have a prominent part in the display. Straight wings for fighters will look as dated as would knee-breeches on their pilots; but even at this late hour there is no indication that Great Britain is to be worthily represented.

We welcome the attitude of the Air Ministry, who recently announced their decision to send squadron aerobatic teams to several Continental air occasions during this year; but why include aircraft types long familiar abroard and already due for replacement in Allied squadrons, let alone in those selected to represent the R.A.F.?

We have to face the fact that the Americans have managed to steal the show at most international air displays on the Continent during the last two or three years. This must not become a habit; while appreciating the importance of preserving the S.B.A.C.'s Farnborough thunder and of keeping new prototypes over the homeland, we feel that it would be a great pity if the British industry's participation in Paris, as well as that of the R.A.F., were confined to the appearance of a few relatively dated designs. There is more than one new type which made its début at Farnborough last year, or even in 1951, which could well be spared for Le Bourget on the important weekend on July 4-5th.

But perhaps an announcement regarding additional British participation is impending, or maybe we are all to be taken by surprise when the time comes.

Current Thought

TELEVISION viewers and radio listeners have been asked to make sure that they and their friends do not use electrical appliances which are not fitted with suppressors, particularly during the weeks of the Coronation celebrations. There have also been short feature programmes designed to persuade motorists to fit suppressors on their car ignition-systems. But these precautions will not prevent interference from aircraft. Readers whose homes are beneath airways will, no doubt, be familiar with the peculiar pulsating and fading effects which airliners of all sorts flying at heights of up to 4,000ft overhead can produce on their television screens. This seems to be a matter, so far neglected, which needs investigation, especially as refinements in the quality of television reception tend to accentuate the effects of interference.

SUPERSONIC BANGS

An Authoritative Report: Experiment and Theory Discussed

AERODYNAMIC noise—in particular the supersonic bang—is causing increasing concern as part of the general noise problem associated with present-day and future jet-powered aircraft. At the recent all-day symposium on aeronautical acoustics, jointly held by the Royal Aeronautical Society and the Acoustics Group of the Physical Society, much interest in this aspect of the noise problem was evident. We hope to print a general account of the symposium in a forthcoming issue, but here we give as an important preface a review of a significant report referred to by several speakers at the symposium. The report published by the College of Aeronautics, Cranfield (where much research into the propagation of such noise has been carried out), is printed in full in the June issue of the R.Ae.S. Journal.

THE discussions which took place in the columns of *Flight* in the autumn of 1952 on the nature of the "supersonic bang" aroused wide interest in the shock-wave patterns around accelerating bodies and in the noise associated with shock waves. A recently published report* from Cranfield discusses the shock-waves which are formed around an aircraft during its acceleration through the speed of sound and on its subsequent deceleration to subsonic speeds, and use is made of the analogy between water surface waves and shock-waves to photograph the pattern of the latter.

The report begins with an outline of the characteristics of the ear. Any complex wave-form is resolved by the ear into a series of pure notes of varying intensity and even if the noise persists for only a short time the ear is able to determine its pitch. Only two successive cycles are needed for the determination of the pitch of most pure notes in the audible range, and the ear will respond to a sound of even shorter duration if it is sufficiently loud. An electric spark, for example, lasting one-thousandth of a second, will be heard as a "chirp," and there is no doubt that the ear will respond to a shock-wave and be able to assess its strength and direction.

It has been suggested that the noise emanating from a point source of sound moving at the speed of sound towards an observer would, due to Döppler effect, arrive (with the aircraft) at a frequency beyond the audible range and thus not be heard. It is pointed out that this simplification is misleading since, firstly, there are sources of sound associated with a real aircraft which are not travelling at the same speed as the body (e.g., eddies in the jet) and, secondly, the shock-waves associated with a real body will be interpreted by the ear as noise.

The nature of the sound emitted by an aircraft at subsonic and supersonic speeds is then discussed. The noise from the engines, airscrews, jets, waves and vortices is much the same at both subsonic and supersonic speeds, but the fundamental change at Mach numbers greater than unity is the existence of the sudden pressure-jumps known as shock-waves. It is known that the ear records a sharp crack or bang when one of these waves passes the ear (the passing of a rifle bullet is an example) so that the explanation of the supersonic bang or bangs is likely to be found in an understanding of the shock-wave pattern round an aeroplane when it accelerates to supersonic speeds.

The shock-waves associated with a simple aerofoil moving steadily at supersonic speed are well known from wind-tunnel photographs and consist of a bow wave (usually passing just in front of the leading edge) and a tail wave springing from the trailing edge; the "sweepback" of the shock-waves increasing with Mach number. Until thoughts were directed to it by the interest in bangs, the fact that another shock-wave often exists was not generally realized. Further consideration has shown that, as an aerofoil accelerates through M=1, a shock-wave detaches itself from the trailing edge (at a Mach number just less than unity) and is left behind by the now-supersonic aerofoil. This shock-wave, like others, continues to move normal to itself at a speed slightly greater than that of sound but is gradually left behind by the aerofoil. The way in which this wave is shed is discussed in detail in the report (Fig. 1) and is illustrated by photographs from the hydraulic tank.

The analogy between the formation of surface-waves round a body moving in shallow water and the shock-waves round a body moving through air is a useful one, and a photograph of the waves round a small accelerating aerofoil is shown in Fig. 2. The report contains many photographs of the wave patterns produced by accelerating and decelerating bodies.

What happens to these waves when the aerofoil decelerates to subsonic speeds is then discussed. The bow wave reduces its "sweepback" near the body and moves ahead of the body, normal to itself, at its steady speed slightly in excess of the speed of sound. An ear somewhere ahead of the wing will eventually receive this wave. (The attenuation is surprisingly small; just as sea waves run for miles without losing strength appreciably, so do shock-waves.) The tail wave also moves forward approximately normal to the surfaces of the wing, but, owing to the finite thickness of the wing, the flow is still supersonic over part of the wing until the wing Mach number has fallen to the critical Mach number—say

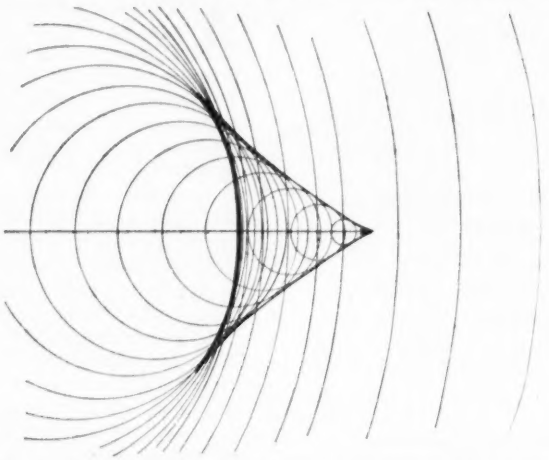


Fig. 1. Taken from the Cranfield report, this diagram shows waves from a source accelerating along a straight line from subsonic to supersonic speed.

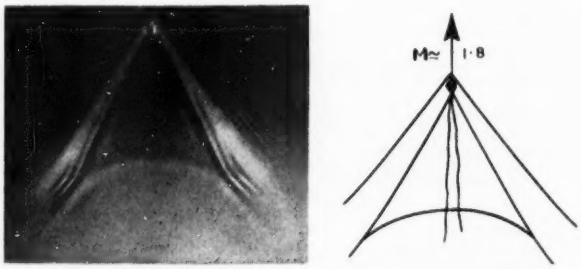


Fig. 2. A photograph from the hydraulic tank, showing a double wedge aerofoil accelerating from subcritical to supercritical speed. The bow wave, tail wave and rear wave can be seen.

M=0.9. Until the deceleration has continued thus far, the tail wave near the wing is held up in its pursuit of the bow wave, but after a short time (perhaps only a fraction of a second) it moves off and follows the bow wave.

The rear wave, which was shed when the wing became supersonic, has been following and begins to overtake the wing when the Mach number falls below unity. Calculations in this report† show that after a typical aircraft supersonic dive it will be only about 100 yards behind the aircraft and will follow about 0.25 sec behind the bow wave.

An aeroplane has shock-waves other than those from the wing, and the waves from the fuselage and tail unit may also be heard. It is known, however, that the response of the ear to a disturbance continues for about 1/100 second so that waves arriving within about ten feet of one another will not be heard separately, but will combine to lessen the sharpness of the bang. (This is why the bow and tail waves of a rifle bullet are not heard separately.)

College of Aeronautics Report No. 71 (Feb. 1953): "On some aspects of noise propagation from supersonic aircraft," by G. M. Lilley, R. Westley, A. H. Yates and J. R. Busing.

†*Similar to those in "Flight," October 3rd, 1952.*

It is thus clear that an observer in the line of flight of the aircraft may hear two or three bangs, whereas an observer slightly off the line of the same flight may hear but one. The essential qualification to be able to hear a bang (according to this simplified theory) is to have had the component of the aircraft speed toward the ear sonic at least once. The shock-wave then formed will travel on towards the ear and eventually cause a bang.

Noise produced by the engines, boundary layers, etc., may also arrive at the ear with the shock-wave. During supersonic flight none of the sound from the aircraft is able to pass the bow wave and some accumulates behind it. Sound from the jet may be prevented from moving forward by the tail wave. The shock-waves are therefore not only discontinuities of pressure but also of noise level. It has been shown, however, that the mere accumulation of noise is insufficient to cause a loud bang and that the sudden pressure-change is the chief cause.

All this assumes a uniform atmosphere. The report shows that if the atmospheric temperature falls with increase in height, as is usually the case, then the speed of sound is greater nearer the earth and a shock-wave is refracted and may never reach listeners on the earth. This effect makes it clear why pilots sometimes find difficulty in aiming their "bangs."

The loudness of the bangs reaching the ground depends on the pressure change across the shock-wave, and calculations show that this pressure-change depends not so much on the actual supersonic speed as on the altitude of the aircraft. Fig. 3 shows the calculated strength of the bow shock-wave from a missile at various heights. The approximate relation between the noise level (usually measured in decibels) and the pressure change is as follows :—

Decibels	lb/sq ft (r.m.s.)	Effect
120	0.4	Present type of bangs
130	1.3	
140	4	Physical pain
150	13	
160	40	Mechanical damage to ear

The report shows that bangs no worse than the present ones will be encountered if supersonic flight is confined to small aircraft at heights above 20,000ft, but a supersonic aeroplane at 5,000ft could cause physical pain to receivers of the shock-waves.

The effect of the pressure-changes from one aircraft on another flying nearby is also discussed. Close to the aircraft the pressure-change is greater than 40 lb/sq ft and the probable effects on other pilots is likely to make supersonic flying either lonely or very unpleasant; formation flying is clearly very unlikely. A warning is also given that the effects of a shock-wave passing over the aircraft is known to cause difficulties in stability and control, and the effect of the comparatively weak rear wave overtaking an aircraft has already been noticed by one pilot.

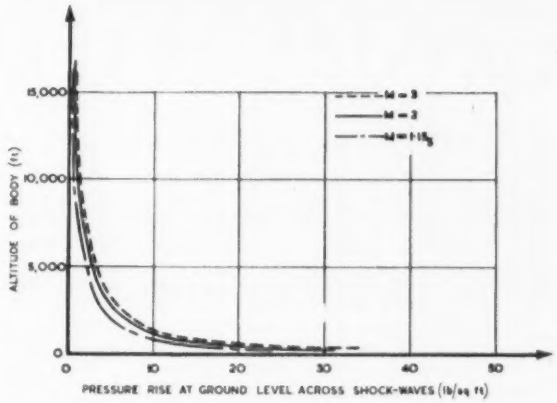


Fig. 3. The approximate pressure-rise at ground level across the bow-wave of a body of revolution, in steady flight, at various heights.

To summarize : This report concludes that :—

(1) The noise heard from supersonic aircraft depends primarily on their shock-wave patterns.

(2) "Bangs" are created not only when the aircraft passes through M = 1 but are constantly created by a supersonic aircraft, and will reach the ground unless they are refracted away.

(3) The shock-waves move normal to themselves at about sonic speed and may, therefore, converge on a point and produce a louder bang if the flight path has been curved or the acceleration considerable.

(4) Steady, level-flying supersonic aircraft will produce widely heard bangs which may be intolerable if they fly below about 20,000ft over land, and may be dangerous if they fly at altitudes below 5,000ft.

"OFF THE BOARD" CONSIDERATIONS

SOME interesting views on aircraft-production matters were expressed by Sir Frederick Handley Page, C.B.E., in his chairman's report at the recent annual general meeting of Handley Page, Ltd.

After mentioning that the Victor had been ordered "off the drawing-board," Sir Frederick observed that there could be misleading impressions of the time which could be saved by this method. The advantage might be lost in cases where an order was not placed sufficiently early or for a sufficient quantity: "Unless plans for production are formulated at an early date, aircraft may be obsolescent at the time when they are entering Service use. It is thus essential that the work of tooling for production should proceed concurrently with the completion of stages in the design and that at an early date similar preparation should be made for the production of the many proprietary accessories that form a large part of the equipment of the military aeroplane. The time taken for the design, development, and production of these accessories is one of the most serious causes of delay in production of the complete aircraft.

"The placing of the production order from the drawing-board at an early stage of the aircraft design would make available a larger number of aircraft for prototype testing and squadron proving than under the conditions where only a limited number, say two or three aircraft, are ordered initially. With a number of aircraft available, trial operation by pilots and maintenance crews of average ability would soon show up the snags which highly skilled handling by the *élite* at testing establishments would miss. Any necessary modifications could be embodied early in the production run. Squadrons would receive developed aircraft with a high rate of serviceability with many of the modifications eliminated at a much earlier stage."

Speaking of production cost, Sir Frederick added that, even where simple unit-manufacture methods were employed, as in the Victor, an unduly small production line was false economy both from the military and financial viewpoint as with small numbers the production layout must necessarily be restricted to more handwork than would be the case where larger initial numbers justified a wider use of jigs and tools.

AMERICA'S AIR TRANSPORT INDUSTRY

IF (writes our correspondent in America) anyone wants to be impressed by the size of the American aircraft and airline industries he should endeavour to lay hands on the April 27th issue of *American Aviation*. Here are some of the figures. The total sales of the leading 16 aircraft manufacturers for 1952 add up to 4,900,663,477 dollars, an increase of 111 per cent over 1951. Their backlog of orders amounts to 14,771,809,886 dollars. (But whether this figure will be realized is another matter, for the hand of economy may soon lie heavily over the armament industries these days.) The operators, too, have contributed to these totals On December 31st last there were some 1,200 civil aircraft being used by the U.S. domestic and international certified carriers, with some 340 (including helicopters) on order. The estimated cost of these as yet undelivered machines is some 298,600,000 dollars (and incidentally these last two figures include the P.A.A. order for the Comet 3).

As to the operating figures, the U.S. carriers hauled 28,381,801 passengers for 15,548,247,000 passenger miles—a gain of 11 and 18.1 per cent over 1951. Combined express goods and freight totalled 233,447,076 ton miles—a gain of 8.6 per cent. But it was in their "coach" services that the real progress was made. During 1952 the domestic airlines here flew 2,309,238,000 coach passenger-miles, an increase of 81 per cent over 1951. All of this resulted in a 13.8 per cent rise in operating revenues to a figure of 1,120,000,000 dollars. But, despite this increase, the danger signals that were flying in 1951 are still there. Net operating income for the combined U.S. certified carriers dropped by 15 per cent, due largely to increased expenses, which went up 21.6 per cent for the domestic operators and 12.4 per cent for the international airlines and 20.7 per cent for the local operators. But the scheduled airlines have new big aircraft on order, and they could face a drop in revenue in 1953 as a result of a decrease in the armament drive. Once the summer is over, there may also be a real problem of how to keep up their passenger loads. This might be done by lowering fares, reducing the transportation tax, or instituting almost 100 per cent coach-class operations. And internationally they are going to face competition—from British-built turbine-engined aircraft.

UNFORTUNATE SWANSEA

Welsh Air Derby Flown in Bad Weather

VIRTUALLY for the third time running, an ambitious air display put on by Swansea and District Flying Club has been largely washed-out through bad weather. In addition to the Welsh Air Derby, a handicap race over four laps of a 22½-mile circuit, there was to have been, last Saturday, May 30th : formation displays by Canberras of No. 109 Squadron, Vampires of No. 233 O.C.U. and *Le Patrouille d'Etampes*; parachute displays by Miss Phyllis Weir and Johnny Ralling; and individual aerobatics by S/L. Mercer (Vampire) of No. 11 Fighter Group H.Q.

In the event only the race, and the Vampire and *Patrouille* formations, took place. Around 3 p.m. the weather was very threatening; it had been drizzling all morning, and Met. said there was no hope of any improvement. And it was a sorry little gathering in the clubhouse which was addressed by the Hon. George Ward, Under-Secretary of State for Air (who had arrived in his Devon to open the display) and the Mayor of Swansea, Cllr. D. J. Fisher. But, in spite of the outside forecasts, it appeared that the cloud base really was going up. Eventually came the good news : the race was on, at 4.15 p.m.

A field of 16 had originally entered but, as time wore on, it become evident that Fred Dunkerley—who won the last Welsh Air Derby in 1951—would be out of the race, with a troublesome engine vibration in his Miles Mercury. Nat Somers, also, was the victim of unserviceability : his Mew Gull needed new undercarriage oleo seals. But he was allowed to race his familiar Gemini and this he did, without even removing the generator fan. The other competitors were all flying familiar types, with the exception of Arthur Jones, the local C.F.I., who had the Swansea B.A. Swallow—a Pobjoy-engined machine with its front cockpit faired over.

This Swallow was, in fact, first away. But its handicap was certainly not overlong, particularly as the strong wind was sure to affect the slower competitors to a greater extent. Visibility was good, but the race was flown in bumpy, gusty conditions, which made the ride rather uncomfortable for some.

The Swallow was sent off towards 4.20 p.m. After it had gone puttering away, there was a wait of several minutes before the Tiger followed; during this period Somers could be seen keeping both his Gipsies at a fast idling speed while, in contrast, Jemmett had his Hawk Major cowling open and was feverishly working at some snag. After the Bowles' Messenger had departed, the Swallow was seen as a speck off Oxwich Point, on course for the airfield. Before it arrived the gaggle of Proctors took off, several slewing to starboard into wind and getting away in a steep turn to port. Nearly all competitors, incidentally, went through large puddles before becoming airborne.

As the field began to complete its first lap it became evident how difficult the wind was making things for all except the more experienced racers. Turns were generally very wide around the airfield pylon, and it appeared that many pilots could have pointed more into wind without cutting the corner. The Leopard Moth, on the other hand, began to turn far too soon and eventually rounded the pylon in a very unpolished manner. Holloway, in the Proctor I, came past very wide and then set a wrong course which must have cost him many precious seconds. But Somers, Fillingham and Paine, particularly, were cornering in the best professional manner : a vertical bank, and the aircraft pulled round very tightly as the pylon appeared underneath.

"Flight" photograph

Winner of the 1953 Welsh Air Derby, S. A. Holloway—a newcomer to racing. His mount was a Proctor I which he had himself modified.

At this stage a most surprising report was received : the No. 25 Group R.O.C. observers at Oxwich telephoned that all competitors except one had turned incorrectly at their corner. It was only when the observers reported in person, after the race, that this was found not to have been the case; if it had, presumably the race would have been declared abandoned.

The only obvious changes in position were "Sailor" Parker, who moved up in the first lap; Bowles, who passed two in two laps; and the Tiger, which beat the Swansea Swallow on the second lap. One point worth noting is that, at the end of the second lap, Holloway approached the airfield with the Chipmunk and seemed to be rapidly overhauling it. But came the turn : Fillingham turned spot-on-the-pylon while the Proctor swept round wide and set course again some hundred yards behind. But Holloway was the first man home, as the table shows.

He is an engineer employed by Airwork at Langley. Although he first flew in 1938, he is not an experienced pilot and had not, in fact, raced before. He did not even go round the course prior to the race; he tried on the morning of the race, but got lost in the haze and saw only one turning point. The Proctor was quite standard, except for a new exhaust and cowling arrangement—devised by Mr. Holloway—which was illustrated on p. 323 of our issue of September 5th last in connection with its appearence in the Siddeley Trophy race at Baginton last summer, when it did 166 m.p.h.

After the race, the *Patrouille* put on one of their superb shows; in spite of the gusty weather they even managed to keep station during their "vertical spectacles," which involve a normal loop and an outside loop in succession. And so ended a day which, although it produced a fine race, was a bitter disappointment to the hard-working Swansea flying folk. They must have shown a very severe financial loss, although the Corporation guaranteed them £350, and, we believe, all winning pilots turned over their prize money to the Club. "Better luck next time" is the appropriate comment.

W. T. G.

WELSH AIR DERBY

Pl.	Pilot	Aircraft	Start order	H'cap. time m. s.	Av. speed m.p.h.
1	S. A. Holloway ...	Proctor I	11	16 10	153
2	J. N. Somers ...	Gemini III	12	17 05	158
3	G. R. I. Parker ...	Proctor V	8	14 45	143.5
4	J. Rush	Falcon Six ...	14	18 25	164
5	P. Hillwood ...	Proctor I	9	15 00	143.5
6	J. P. Crowther ...	Proctor III ...	10	15 15	144.5
7	W. P. Bowles ...	Messenger IIa ...	5	12 00	129.5
8	R. R. Paine	Hawk Speed Six ...	15	21 15	184
9	H. J. G. Turner ...	Proctor III ...	7	14 15	137
10	A. J. Spiller ...	Leopard Moth ...	3	11 10	124
11	W. P. I. Fillingham	Chipmunk I ...	6	13 55	134.5
12	D. FitzGerald ...	Nighthawk ...	13	17 25	152
13	C. H. Davies ...	Tiger Moth ...	2	03 45	100
14	D. C. Jemmett ...	Hawk Trainer III ...	4	11 20	122.5
15	A. Jones	B. A. Swallow ...	1	00 00	88

BRITISH AIR RACING CHAMPIONSHIP

Competitor	Welsh Air Derby points	Total	Competitor	Welsh Air Derby points	Total
G. R. I. Parker ...	13	33	F. Dunkerley ...	0	8
J. Rush	11	27	D. C. Jemmett	2	7
R. R. Paine ...	5	27	Miss E. L. Curtis	0	6
J. P. Crowther ...	7	25	H. J. G. Turner	4	4
P. Hillwood ...	9	21	G. C. Marler	0	4
J. N. Somers ...	15	18	D. FitzGerald ...	2	2
S. A. Holloway ...	17	17	A. Jones	2	2
W. P. Bowles ...	6	15	C. H. Davies ...	2	2
D. J. Bennett ...	0	14	G/C. C. M. M. Grece	0	2
A. J. Spiller ...	3	13	H. C. Willson ...	0	2
A. S. K. Paine ...	0	11	A. Bough ...	0	2
W. P. I. Fillingham	2	9			

HOMING at REARSBY

Precision Flying and Church Recognition

THE family reunion that is the Auster-Ragosine Homing Trophy competition brought some 30 vari-coloured members of the Auster clan, young and old, back to Rearsby on the gusty morning and afternoon of last Saturday. Encountering the turbulent wind, and reading the competition rules and briefing instructions, one wondered why people really wanted to submit to the refined torture implied therein. For accurate navigation, accurate flying, accurate time-keeping—all this and church-identification too, were blandly demanded by the organizers.

Willing to hazard their nerves and reputations in quest of the vast-capacity trophy were representatives from many clubs; 40 entries had, in fact, been received, but the rough weather deterred some 25 per cent. Ages and types of Austers (and pilots) attending varied considerably, while among the crews were several women navigators and two women pilots. One, Miss Herbert (a V.R. pilot of the W.R.A.F.), flew with Miss Pat McKim (until recently secretary of the Helicopter Association) navigating. The smart Belgian Aiglet Trainer OO-CHT was flown by Miss R. M. Sharpe, test pilot for W. S. Shackleton, Ltd., and the other Belgian-registered machine present, OO-ABU (a Continental-powered Arrow) was flown by Monsieur R. Heuvelmans—Auster's Belgian representative—with Madame Heuvelmans navigating.

The briefing instructions, given to each pilot 40 minutes before take-off, described the four turning points and specified the required times and speeds, and the ground objects to be identified. These ground objects comprised a large number of village churches —a change from the factory chimney theme of last year. Demerit marks were added for inaccurate flying and faulty recognition, while credit marks could be obtained for, among other things, good landings near the marked square. Three technical questions from the ground marshals greeted each competitor as he cut his engine after taxying in—a dastardly final blow.

During the day, the sight of the various Auster aircraft taking off, landing, disappearing into and emerging from the cloud-swept sky gave little clue as to their relative progress. Judges in the tower spent a vigorous day signalling, judging and recording. Crews on landing gave varying reports; some denied the existence of certain turning points, and Monsieur Heuvelmans complained of "too many little things on the map." Meanwhile the work of the ground handling crews, marshals and refuellers ensured that take-off delays were very few.

It was that same evening, at the dinner and dance held in Leicester to mark the occasion, that it became possible to piece together a reasonably coherent overall picture. The full course, approximately 100 miles, should have taken 1 hr 27½ min; one pilot had taken 2 hr 19 min, and one had not yet returned. One aircraft had been reported flying east from the most easterly turning point, and there had been five cases of airsickness. For the oil company, one representative made an unofficial forecast for future meetings—Ragosine oil *with chlorophyll*.

"Flight" photograph

Winners of the class prize—a Fairey Reed airscrew—for the best performance by an overseas competitor at Rearsby, Monsieur and Madame Heuvelmans, here pictured just before take-off.

After the dinner, representatives of the two sponsoring bodies spoke. Mr. A. Harman, chairman of the Auster Flying Club, proposed "Guests and Pilots," and Capt. F. C. Wayman—giving a somewhat critical description of present-day air racing—proposed the toast of "the Homing Cup." The doubts concerning the winner's identity were removed a little later, when the presentation of prizes was made by Mrs. Wayman.

The first prize (Trophy, replica and £50 cash) was won by Mr. L. Morris (pilot) and Mr. D. Gamble, of the home team, the Auster Flying Club. As their 5J.4 machine, G-AIZT, had a Cirrus Minor engine, the Cirrus Trophy also went to Mr. Morris. Runner-up was last year's winner, Mr. G. A. Farley, flying Lec Refrigerators' J.5B Autocar, G-AJYY, and third came Mr. John Radford in his 5J.1 Autocrat, G-AIBY, with Miss Z. Paddon navigating. The Fairey-Reed metal airscrew, for the best performance by an overseas competitor, went to Monsieur and Madame Heuvelmans. Other prizes were presented also, including the Ladies' Prize to Miss Paddon.

In an interview following the dinner, the competition secretary, Mr. F. Watkin, commented that the competitors' skill was improving each year (this was the sixth), and so the contest was made more difficult. The day's gusty weather had proved an additional test. Mr. Watkin then told an unusual story of one competitor, a naval lieutenant from H.M.S. *Perseus*, who had begun the first leg on a reciprocal course, flown off the map, landed at a disused airfield near Peterborough, and taken part in an ox-roasting ceremony, after which the chief ox-roaster—who operated his own Messenger—had refuelled the lieutenant's Auster, enabling him to return to Rearsby 4½ hours after his original departure and to arrive at the dinner only 90 minutes late.

The most unusual part of that story proved to be its complete truth.

K. T. O.

COMET IN CANADA

FIRST de Havilland Comet to land on the North American continent, the Series 1A, number 5301, of the Royal Canadian Air Force arrived according to plan at Uplands Airport, Ottawa, last Friday. This Comet is one of two ordered by the R.C.A.F. for transport and for fighter and radar affiliation exercises. Canadian Sabres were briefed to intercept the Comet over Montreal and to escort it to its historic landing at Uplands.

The route selected for this first jet-transport crossing of the Atlantic was from London Airport to Keflavik (1,180 miles, flight-plan time 3 hr 15 min); Keflavik to Goose Bay (1,495 miles, time 4 hr 15 min); Goose Bay to Ottawa (870 miles, time 2 hr 30 min). The total time for the journey of 3,545 miles was 10 hr 20 min, compared with the normal transport time of 16 to 18 hours. Landing time was 3.03 p.m. G.M.T.

On its delivery flight 5301 carried two complete crews, some 14 ground-crewmen, and three D.H. representatives who are to remain with the R.C.A.F. Comets indefinitely. The first crew captained by S/L. J. D. Dickson, Flight Commander Comet Flight, comprised F/Ls. D. Broadfoot, K. Wark, C. Brown and F/O. C. Baine. The second crew who flew the long leg to Goose was S/L. S. Olsen, F/Ls. R. Herbert, D. Stewart, R. Chalk and Sgt. W. Hoehn. D.H. reps. are Messrs. Wright, Allen and Jermyn.

R.C.A.F. Comets will carry captain, co-pilot, navigator, radio officer and flight engineer as a normal crew. Those named above have, together with other R.C.A.F. personnel, undergone some seven months of training and preparation. Flying experience has included Comet training flights to Johannesburg and Singapore and several to Rome and Beirut.

Soon the second R.C.A.F. Comet 1A will follow, and another Comet from the parent company is expected to visit the United States later on so that PanAm, who have Series IIIs on order, may carry out tests and route trials.

CORONATION HONOURS

AS this issue of *Flight* closed for press the honours conferred by the Queen to mark her Coronation were made known. Among the numerous personages connected with aviation whose names appear in the list, the most highly honoured are Mr. Sydney Camm, director and chief designer, Hawker Aircraft, Ltd., and Mr. T. O. M. Sopwith, chairman of the Hawker Siddeley group, who become Knights Bachelor. Mr. R. Cockburn, scientific adviser, Air Ministry, and Mr. E. T. Jones, principal director, Scientific Research (Air), Ministry of Supply, are made C.B.s and Mr. R. E. Hardingham, O.B.E., secretary and chief executive, Air Registration Board, becomes a C.M.G. Other awards are: W. J. Duncan, Professor of Aeronautics and Fluid Mechanics, University of Glasgow (C.B.E.); A. Fage, superintendent, Aerodynamics Division, N.P.L. (C.B.E.); J. Summers, formerly chief test pilot, Vickers-Armstrongs, Ltd. (C.B.E.); Capt. M. J. R. Alderson, fleet manager, Comets, B.O.A.C. (O.B.E.); W/C. R. P. Beamont, chief test pilot, English Electric Co., Ltd. (O.B.E.); G. H. Miles, chairman of executive committee, Association of British Aero Clubs and Centres (O.B.E.); C. T. Wilkins, assistant chief designer, de Havilland Aircraft Co., Ltd. (O.B.E.); H. J. A. Hill, sales manager, London, B.E.A. (M.B.E.). Capt. R. Rymer, training captain, Viscount Flight, B.E.A., receives the Queen's Commendation for valuable service in the air.

R.A.F. honours appear on page 737 and a complete list of civil honours of aeronautical interest will appear in our next issue.

FROM ALL QUARTERS

REHEARSING for a Coronation Day shuttle service between Alexandra Palace and London Airport, with T.V. films, this Bristol Sycamore of No. 275 Squadron, Fighter Command, is seen (with some difficulty, by virtue of its camouflage) shortly after take-off. The squadron is commanded by F/L. D. Kearns and has been temporarily based at R.A.F. Station, North Weald. "Flight" photograph

Swift F.4

BEARING the above designation, a new version of the Vickers-Supermarine Swift fighter, now in super-priority production for the R.A.F., recently made its maiden flight at Chilbolton. It was flown by Mr. M. J. Lithgow, the company's chief test pilot. The power unit is a Rolls-Royce Avon with two-position reheat, and various modifications have been incorporated, including "more powerful" armament. In this connection it may be remarked that the Swift, as displayed at Farnborough last year, had only two cannon ports, whereas the Hawker Hunter had four.

It is the makers' claim that the Swift has climb, endurance and manoeuvrability unsurpassed by any fighter in the world.

T. W. Hayhow

AS we briefly recorded last week, Tom Hayhow's Auster Aiglet —in which he had been attempting a London-Belgrade record on April 10th—was sighted by skiers on May 25th. It lay on its back, apparently not badly damaged, in a hollow at 6,000ft between the Grosser and Kleiner Breitstein peaks, 20 miles south of Salzburg.

Shortly afterwards, news reached London of the finding—by American Army and Austrian skiers—of the pilot's body, some 600 yards from the aircraft. He had suffered only minor injuries, and it was assumed that he had died from exposure in the deep snow whilst trying to make his way down the mountainside. Other evidence pointed to the fact that he had reached the Klagenfurt area, turned back towards Salzburg owing to bad weather, and eventually run out of fuel. He had been approximately on track.

Thus passes a good sportsman who during the past few years has consistently supported air racing and who, within the last twelve months, had made a unique series of 28 solo record flights between London and various European capitals. Forty-six years of age, he was a director of engineering and automobile businesses and of a small air-charter firm; he leaves a widow.

From Nat Somers, writing on behalf of his fellow-members of the Throttle Benders, comes this tribute: "It is hard to realize that the jovial personality of Tom will no longer be with us. He was always wisecracking, and was the life and soul of our air-racing parties".

America's Air Strength

A NUMBER of significant statements on air power have been made lately by three highly-placed Americans.

President Eisenhower said that no specified number of aircraft could be said to constitute security, but added—in answer to a question—that 60 per cent of next year's national defence allocation would be devoted to air power and air defence. He also stated that three aircraft with modern weapons could practically duplicate the destructive power of all the 2,700 unleashed in the Normandy break-out. (Presumably, he was referring to atomic weapons.)

Mr. Short, chairman of the House of Representatives Armed Services Committee, said that American air power had been almost doubled since the Republicans came to office in January, there now being 73 fully-equipped Air Force wings as against only 47 at that time. The target for July 1954 is 114 wings, according to Mr. Wilson, Defence Secretary.

General Gruenther claimed that the Russians had 20,000 aircraft in operational units, and that lack of air power was the West's most serious difficulty. He also expressed the view that we had not yet found the answer to schnorkel submarines, which the Russians were building in large numbers.

Messerschmitt on German Revival

LECTURING at Düsseldorf recently on Germany's probable future in aviation, Prof. Willy Messerschmitt gave it as his opinion that the industry would "very soon make considerable progress." Design and production capacity for the manufacture of aircraft existed in the German Federal Republic and, though output might be below that of foreign countries, wages were lower and the industry should thus be able to compete with other nations on a price basis. He said that special emphasis should be placed on the building of specialized aircraft, the manufacture of which entailed enormous costs in other countries. Also, in addition to manufacture under foreign licences, for which contacts had already been established, German-designed production must be developed, among which the construction of training, sports and small touring aircraft must be given pride of place. Next, the construction of twin-engined and four-engined aircraft must be undertaken.

Robert Desoutter

WE greatly regret to learn of the death—on May 11th—of Mr. Robert Desoutter, the surviving member of the three brothers who founded the firm bearing their name.

As many of our readers are aware, Desoutter Bros, Ltd., started their business as makers of artificial limbs, and Robert Desoutter taught himself a great deal about anatomy and surgery, so that in time he found himself accepted by surgeons as a leading authority on all aspects of the fitting of such aids. In the middle thirties, when the importance of the portable-tool side of the firm began to rival that of the original business, he took over the development of the export side; and when Charles Desoutter died suddenly in 1947 (Louis had lost his life in a gliding accident before the war), Robert found himself shouldering very heavy responsibilities. So sound was his direction, however, that in the following five years the company's turnover actually doubled.

A friend writes: "The future of the firm is safe in the hands of the next generation of Desoutters, but it is hard to say good-bye to Robert so soon . . . he was a gay, amusing companion to whom laughter came easily. To a tremendous zest for life . . . he added the traditional Desoutter love of thoroughness and fine craftsmanship."

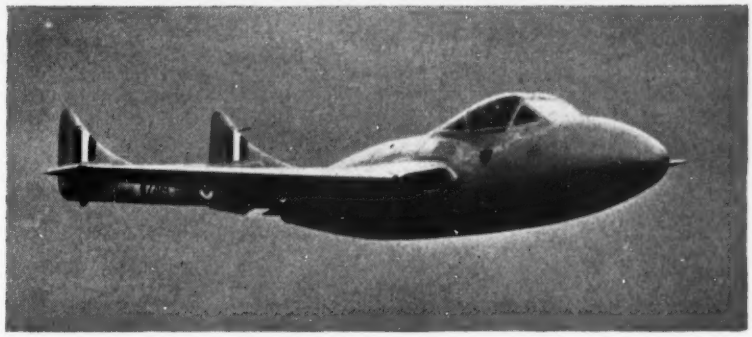
About Plastics

ON Monday next, June 8th, the second British Plastics Exhibition and Convention opens at Olympia, London, and remains open (Sunday excepted) until the 18th. Nearly 100 exhibitors will be represented, and at the convention 22 papers will be read. The inaugural lecture, at 4 p.m. on June 8th, will be given by the Earl of Halsbury, F.R.I.C., F.Inst.P. (managing director, National Research Development Corporation); his subject will be the introduction of R.A.E. reinforced-plastics techniques to industry. Five other papers of interest to the aircraft industry will be given, on Wednesday, June 10th, as follows:—

Morning Session: *Surface Chemistry and Adhesion of Glass and Plastics*, by H. Cole, M.A., F.R.I.C., F.S.G.T., of Pilkington Bros., Ltd.; *Plastics Containing Asbestos as a Reinforcing Filler*, by J. E. Gordon, B.Sc., P. H. H. Bishop, B.Sc., and P. L. McMullen, D.L.C.(Aero Eng.), all of the R.A.E., Farnborough; and *A Critical Survey of Commercial Low-pressure Laminating Resins*, by V. E. Yarsley, D.Sc., F.R.I.C., F.P.I., and A. G. Goodchild, B.Sc., A.R.I.C.

Afternoon session: *Some Considerations in the Design and Manufacture of Structures in Glass-reinforced Plastics*, by G. C. Hulbert, B.Sc., of the Bristol Aeroplane Co., Ltd.; and *Some Problems Associated with the Design and Manufacture of Asbestos-reinforced Plastics*, by D. S. Bancroft, A.F.R.Ae.S., of F. G. Miles, Ltd.

AIRCRAFT INTELLIGENCE



THOROUGHBREDS; The North American F-86H Sabre (top) has the benefit of nearly 9,000 lb thrust from a General Electric J73 turbojet, which enables the new fighter to climb and manœuvre at least as well as the Mig-15. Rather larger than earlier Sabres the "H" is distinguished by a fatter fuselage. The D.H.115 Vampire Trainer (below) is fully modified to the new standard, including extended fins, ejection seats and frameless canopy.

Great Britain

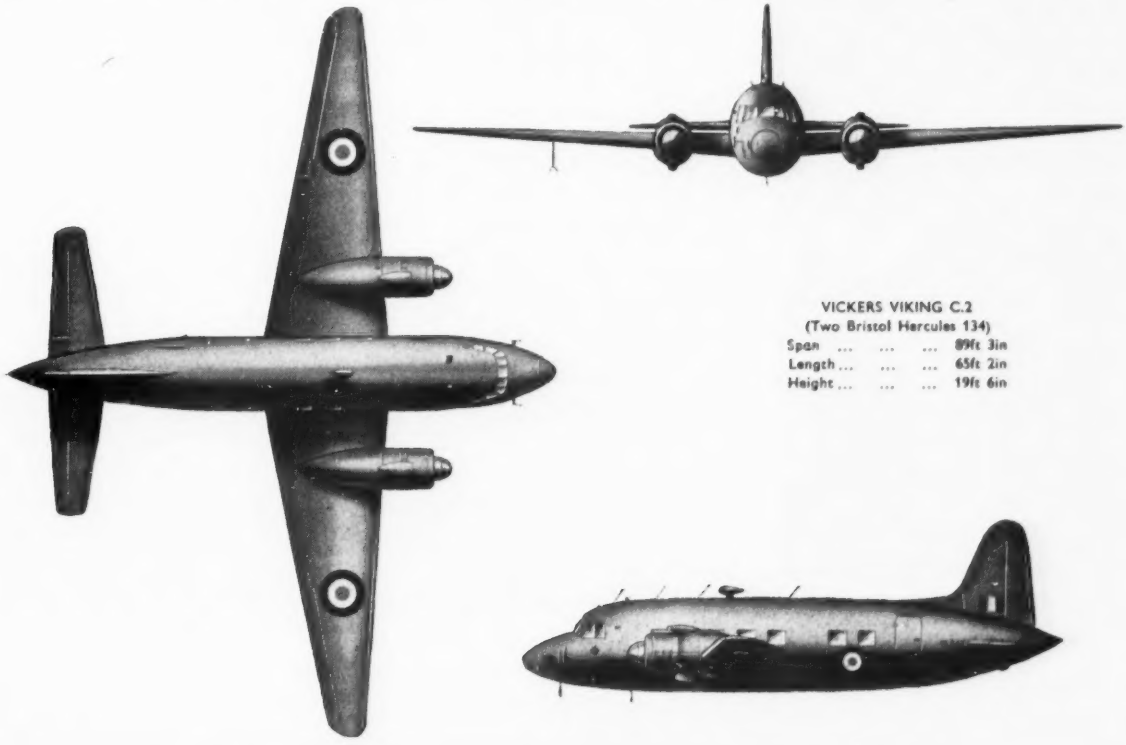
Fairey Rotodyne. Although it is not necessarily representative of the Rotodyne turbine-driven winged helicopter, a tip-drive rotor test-rig has been operating at the Fairey Company's White Waltham premises for some time past. From a recent lecture on aircraft noise it appears that the rig employs a Rolls-Royce Dart turboprop which supplies compressed air to the rotor blades; fuel is also supplied and burnt at the blade tips. The noise-level of the rig is stated by the National Physical Laboratory to be "encouraging."

Folland Gnat. Although Folland Aircraft are very anxious that details of their light-fighter project should not yet be made public, a number of writers have disregarded the company's wish. An account (in the Italian journal *Alata*) quotes the following figures: engine thrust, 4,000 lb; all-up weight, 5,500 lb; wing area, 123 sq ft; maximum speed, 725 m.p.h.; ceiling, 55,000ft. The maker's number—Fo.141—is also given. The same article goes on to give basic characteristics of two of the Gnat's possible power units, named as the Turboméca Ossau and Bristol Saturn. Data are also given for the Javelin and North American Sabre series and F-100, but much of this information appears conjectural.

Vickers Viking. We have chosen the familiar Viking for our three-view drawing this week, for this type of aircraft equips the King's Flight. (It may be noted that this unit is still so termed, officially, although now usually referred to as the Queen's Flight). The aircraft shown, typical of the four on the strength of the Flight, is known as Viking C.2 by the R.A.F. and virtually parallels the civil Mk IB. Points of interest are the asymmetric tailplane, the wing-root intakes and the blunt Service-type spinners.

U.S.A.

Boeing B-47C. It is now evident that this Stratojet development will be powered by four Allison J71-A-5 turbojets in four single nacelles, and not in two twin pods as might have been expected. These single nacelles are stated to be unusually neat, and there is talk of them being put into production for the Douglas RB-66, which will take only two pods each. The B-47C is being developed as a faster and more economical bomber than the lower-powered six-jet versions now in large-scale service. Yet a further type of B-47 is one now being modified to take four Wright T49 turboprops driving Curtiss wide-bladed airscrews.



VICKERS VIKING C.2
(Two Bristol Hercules 134)

Span	89ft 3in
Length	65ft 2in
Height	19ft 6in

HERE AND THERE

U.S.A.F. F-86 SABRES are likely to be regular visitors to air displays this summer. These eight appeared at Elmdon's Whit-Monday event, described last week.

"Flight" photograph

Flying Grandstand

A SOLENT of Aquila Airways is to make one-hour, 150-mile, luxury tours of the Coronation Naval Review area, cruising at 1,000ft in a special zone permitted by the M.C.A. Fares will be £12 on June 15th and £10 on the 14th and 16th.

Taking it Down

SCHEDULED for the fastest commercial flight ever made between the United Kingdom and Australia, a Constellation of Qantos Empire Airways was due to leave London Airport at 9 p.m. on Coronation Day with films and photographs for delivery in Sydney 58 hours later.

Mapping a City

MORE information is now available about the large-scale air-survey of housing sites in Sheffield, recently referred to on this page. The work was undertaken by Meridian Air Maps, Ltd., of Shoreham Airport, who employ a Miles Aerovan flying at as low a ground speed as 50 m.p.h. in order to reduce image-movement. A six-inch camera lens allows a photographic scale of 1 : 1,200 to be obtained, from which plans on a scale of 1 : 500 are prepared. Contours, it is stated, are accurate to half the vertical interval, i.e., to 6in, and horizontal detail is accurate to plus or minus 6in.

Taking Shape

HAVING completed the full-size plaster model of the Alcock and Brown Memorial, the sculptor, Mr. William McMillan, R.A., is now working on the actual memorial, which is to be in Portland stone. It will be erected at London Airport. Since a public appeal was made last September, a little over £3,500 has been subscribed towards the cost, which will be £5,000. Further subscriptions will therefore be welcomed; cheques should be made payable to the Royal Aero Club, and crossed "Alcock/Brown Memorial."

ATLANTIC PIONEERS: The design for the Alcock and Brown Memorial (see "Taking Shape.")

Jersey Display

ON Thursday, July 9th, the Harbours and Airport Committee of the States of Jersey is to hold an air display at Jersey Airport, from 3.30 to 5.30 p.m.

Australian Canberra's Flight

ON May 28th, the first Australian-built Canberra made its initial flight, with completely satisfactory results, at the new Avalon Airfield near Geelong. Mr. Eric Harrison, Minister of Defence Production, said that several more of the 48 initially ordered for the R.A.A.F. were well advanced on the production line. He added that the first of the Australian-built Avon-Sabres would fly this year.

Regal Reduxing

THE wheels of the State coach—which was built in 1761—were shod with rubber tyres for the Coronation. After preliminary tests by the Dunlop Company, it was decided that the iron rims, which in places were more than 1in out of true, would have to be rebuilt with Araldite synthetic resin and rubber strips bonded to them by the Redux process. By permission of the Crown Equerry and the coachbuilding firm of Hooper, the story of the rebuilding is told by Aero Research, Ltd., in the current issue of their *Technical Notes*.

Rewarded

THE "densified wood" material used for airscrew blades and other aeronautical purposes has brought Dr. Bruno Jablonsky £15,000 under a decision of the Royal Commission on Awards to Inventors.

Kurt Tank on the Mig-15

SPEAKING at Goettingen, Prof. Kurt Tank, former chief designer to Focke-Wulf and now head of the State Aeronautical Institute in Cordoba, Argentina, has expressed the view that the Mig-15 is based on the design of his own Ta 183. Prof. Tank, who was lecturing to the Society for Aeronautical Science in Goettingen, adds that he thinks it likely that his designs fell into the hands of the Russians when they occupied the German Aeronautical Research Institute at Berlin-Adlershof in 1945. Prof. Bock, who was in charge of the Institute at the time, was taken into Soviet custody and was later heard of from time to time from the U.S.S.R. Prof. Tank also spoke of Argentina's series of Pulqúi jet fighters, a more powerful night and all-weather version of which is now under development.

Prince Bernhard at Brough

IN England to attend the Coronation, Prince Bernhard of the Netherlands last Sunday flew from Northolt to Brough, East Yorkshire, to inspect and fly the Blackburn Universal Freighter. During two of three flights over Lincolnshire with Blackburn's chief test pilot, Mr. Tim Woods, the Prince took over the controls.

Offshore Radio Order

THE Procurement Division of the U.S.A.F. in Europe has placed a $1,400,000 "offshore" order for ground-to-air V.H.F. radio transmitters, receivers and spares with a British firm, the General Electric Co., Ltd. The transmitters are of similar design to those now being manufactured by the company for the Ministry of Supply.

Fly-Past D.F.

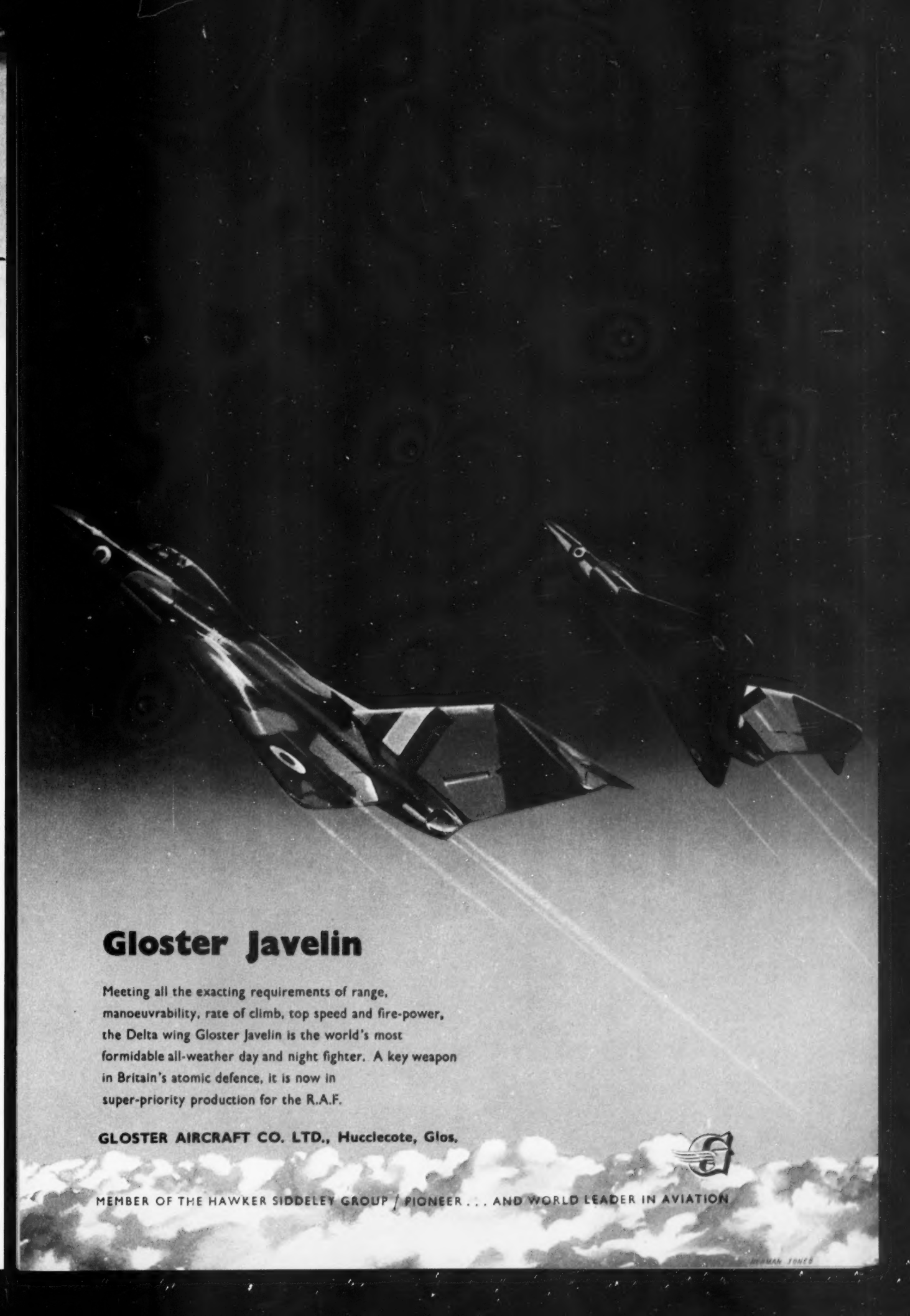
USED during the Coronation fly-past, and also to be employed for the Royal Birthday fly-past by Bomber Command Canberras, a temporary V.H.F./D.F. installation, utilizing the Standard Telephones P.V.1.B. automatic D.F. equipment, has been established in Regent's Park, London. The impossibility of securing "line-of-sight" transmission in such a situation—especially to aircraft flying at under 1,500ft—has been circumvented by a special aerial system giving bearing accuracy of better than 1 deg over a relatively narrow (40 deg) sector centred on the line of approach. Similar equipment will be used for the R.A.F. Review fly-past at Odiham.

Export Record

"AEROPLANES, airships and balloons and parts thereof (except magnetos, rubber tyres and tubes)"—to quote the official definition of Britain's aviation exports—valued at £4,899,490 were exported during April. This compares with £3,737,490 in 1952 and £3,736,533 in 1951 and brings the total for the first four months of 1953 to a record figure of nearly £19m. Now being added to by exports of jet airliners and bombers, the total for the year is expected to reach £60m.

Soaring Figures

ONE significant aspect of the export picture is that the firms who have been able to export the greatest proportion of their products during recent years are Slingsby and Elliotts, the two manufacturers of gliders and sailplanes. Sometimes as much as 80 per cent of production capacity has been exported, and a considerable fillip was given to sales generally by last year's British victory in the International Gliding Championships. Both companies are developing new sailplanes, in spite of the high development cost, which may now be as much as £10,000.



Gloster Javelin

Meeting all the exacting requirements of range, manoeuvrability, rate of climb, top speed and fire-power, the Delta wing Gloster Javelin is the world's most formidable all-weather day and night fighter. A key weapon in Britain's atomic defence, it is now in super-priority production for the R.A.F.

GLOSTER AIRCRAFT CO. LTD., Hucclecote, Glos.

MEMBER OF THE HAWKER SIDDELEY GROUP / PIONEER . . . AND WORLD LEADER IN AVIATION

MADE IN ENGLAND

TIMKEN

TAPERED-ROLLER BEARINGS
IN
HELICOPTERS

Illustration by courtesy of Westland Aircraft Limited.

BRITISH TIMKEN LTD.,
DUSTON, NORTHAMPTON; & BIRMINGHAM

REGISTERED TRADE MARK:
TIMKEN

ELECTRONICS on VIEW

An Officially-sponsored Display of British Equipment

BRITISH electronic development during World War II promoted a great expansion of our radio industry; nevertheless, capacity was strained to the utmost to meet the vital commitments of research and production. Today the position is somewhat changed. There is plenty of scope in every field of activity but, for the first time, our powerful radio industry is in a position where it can supply large quantities of modern electronic equipment to friendly overseas buyers.

This is a most heartening sign and it shows that, far from becoming a nation renowned only for our great strides in research and development, we are backing this immense effort up with an already considerable export trade in electronic devices of all kinds. But, in spite of this trade, it appeared that much good could result from a comprehensive exhibition of the latest equipment now available against firm delivery dates in order to show overseas visitors the many things that we have and they have not.

Accordingly, a private display was last month organized by the Radio Communication and Electronic Engineering Association at the instigation of the Ministry of Supply. Admission was restricted to delegates nominated by the Ministry: about 200 attended from sixteen countries, and from the staffs of SHAPE and NATO. The venue chosen was the R.A.E., Farnborough—around Cody's Tree—and the general set-up resembled the S.B.A.C. Display, with a large indoor exhibition of equipment and components, in separate halls, and outdoor and flying demonstrations.

There were 63 exhibiting firms, all but four of whom were members of the R.C.E.E.A., the Radio and Electronic Manufacturer's Federation or the British Radio Valve Manufacturer's Association. Their products included fixed and mobile communication equipment, various applications of radar, radio navigational and bad-weather aids, and related equipment such as testing gear, valves, laboratory equipment and components. Much of the apparatus was shown working and the greater part of the exhibited equipment was in production for the British fighting services.

Opening the display, Mr. Duncan Sandys, Minister of Supply, said: "Great Britain was the first country to create a radio industry and we are proud of the fact that in many ways she is still leading the world, both in research and in high-quality manufacture. British electronic equipment is at present being supplied to the Air Forces of 19 countries and to numerous civil airlines throughout the world. . . .

The proportion of Britain's defence expenditure devoted to electronics is today over four times what it was in 1939. In the case of a modern bomber aircraft, electronics represent nearly 10 per cent of its total cost compared with only about two per cent before the war."

The following is a synopsis of the equipment shown.

Equipment Hall

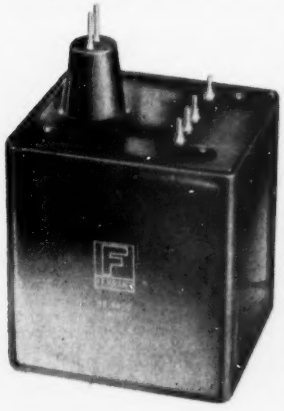
Airmec, Ltd., High Wycombe, Bucks.—Aircraft intercommunication systems, stabilized power units for high-voltage Klystrons and a considerable amount of industrial electronic apparatus, and fault-finding, testing and measuring equipment.

Automatic Telephone and Electric Co., Ltd., London, W.C.2.—All types of telephone equipment, V.H.F. transmission equipment, radio survey vehicles and other (principally ground-based) apparatus.

British Communications Corporation, Ltd., Wembley, Middlesex.—A.M. and F.M. U.H.F., V.H.F. and H.F. communications, field and laboratory test gear and wide-band amplifiers.

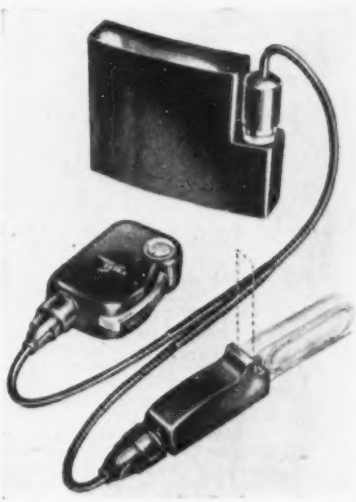
British Thomson-Houston Co., Ltd., Rugby, Warwick.—Electronic airborne computors, airborne speed- and voltage-regulators, high-energy gas-turbine ignition units and ignition testers. The company also showed a great amount of marine and military radar, a variety of special valves, many with airborne applications, and much industrial equipment.

Burndept, Ltd., Erith, Kent.—A most interesting exhibit was the X1512 Air/sea Rescue Dinghy Automatic Beacon. Developed by the Vidor-Burndept Group in conjunction with the R.A.E., Farnborough, this lightweight transmitter is powered by a Vidor Kalium battery which lasts for 36 hours at "normal" temperature and 24 hours at 0 deg C. The transmitter, which measures 4in by 2in, sends an automatic distress signal every two seconds on normal wireless channels; the quoted range is 60 miles.



This transformer, Type RD 4470, is one of the Ferranti "Pentland" series, the unique construction of which is described on this page.

Type B.E.219 is a lightweight transmitter/receiver in production for "single-seat jet fighter aircraft for the Royal Air Force." Weighing but 9 lb, including an anti-vibration mounting tray, the B.E.219 (formerly TR 2002) is an air/ground set operating on any single channel in the 117-128 Mc/s band.



The largest part of Sarah (page 720) is the battery, carried in a pocket of the life-jacket. The smaller units are the microphone and transmitter/aerial unit.

Type B.E.201 is a tropicalized and mobile 4-channel V.H.F. set which enables aircraft to maintain close touch with ground artillery. A Burndept airfield-control V.H.F. transmitter and its military development were also on view, both of which are the subject of very large orders. Also of interest is the fact that Vidor-Burndept claim to have produced the first neutron monitor outside the U.S.A.; three items were shown which had been developed jointly with the A.E.R.E., Harwell, and one item had been used at Monte Bello.

Cinema-Television, Ltd., London, S.E.26.—Previously seen at this year's Physical Society Exhibition was the flying-spot television scanner which projects a microscope slide image on to a 3½in screen. CinTel also showed a ground-traffic indicator, for airport supervisory control, but the major part of their output is in non-aeronautical fields.

E. K. Cole, Ltd., Southend-on-Sea, Essex.—Ekco airfield radar is deservedly well-known and an example was in use in the outside demonstration area. This equipment, sometimes referred to as "the poor man's G.C.A" should in no way be looked upon as an incomplete or makeshift device. Combining pencil-beam radar with V.H.F./D.F. the Ekco Airfield Approach Aid, as it is termed, provides complete one-man talk-down facilities for all types of aircraft. Other indoor exhibits ranged from miniaturized communications equipment to an airborne plotter of centimetric aerial polar diagrams.

But the most important, and unexpected, item was a radar-ranging unit for installation in fighter aircraft. This was a particularly neat little package, no bigger than about one cubic foot, and it was shown complete with waveguide, scanner and air-cooling pipes. During interception the set sweeps the sky in a small cone directly ahead, and "locks on" to anything reflecting its emission. The range of the target is then continuously passed to the gunsight, unless the pilot decides to ignore the target. The set can be used with the standard gyro gunsight, and it no doubt accounts for the dielectric tip to the nose of the Swift and Hunter.

Cossar Radar, Ltd., London, N.5.—Cossar airborne Gee was fitted in several of the demonstration aircraft and the latest developments were shown on the company's stand. Gee Mk. 111, now in service with the R.A.F. and various civil airlines, shows a significant reduction in size and weight as a result of general miniaturization and the introduction of automatic counting. Three main units—indicator, receiver and wave generator—are used, and the presentation is on a 3in screen.

Gee automatic ground equipment was also on view; this "master" and "slave" equipment is normally duplicated at each ground station to provide complete Gee coverage over a wide range of crystal-controlled frequencies.

In the static park was a mobile Cossor Airfield Radar exhibit. The display console in the vehicle consists of two indicators with a central control unit between them. Each indicator has a 15in diameter tube presenting a P.P.I. display of the air surrounding the airfield, up to a number of selected ranges, about ten miles being a useful maximum. The power comes from a 3cm magnetron which feeds, *via* a number of intermediate devices, into a plastic paraboloidal reflector, 12ft by 3ft, mounted on the roof. Rotating about a vertical axis, the scanner can be tilted between 0 and 6 deg to provide optimum cover with a minimum of permanent echoes.

Electric and Musical Industries, Hayes, Middlesex.—Although only a minor proportion of the E.M.I. stand was devoted to aeronautical equipment, the range of products was so great that this section embraced many fields. One development concerns a special test equipment for airborne interrogator radar, enabling such testing to be carried out on the ground against simulated targets. Other E.M.I. equipment concerned airborne electronic installations for interception of enemy aircraft, aircraft, marine and ground fire-control equipment and various navigational aids. One of the demonstration flights was made *via* Boscombe Down so that delegates could try out D.M.E. with E.M.I. Rebecca ground equipment. A radar-pulse altimeter was also shown, the production version of which should be quite accurate at 60,000ft.

English Electric Co., Ltd., London, W.C.2.—Although, in the aeronautical world, E.E.C. are best known for the manufacture of complete aircraft, the company also manufacture a great amount of electronic and "heavy engineering" electrical apparatus. But little of this has direct aeronautical application.

ELECTRONICS on VIEW . . .

Ferranti, Ltd., Hollinwood, Lancs. Described by Ferranti as "a new departure in the conception of transformer construction," the Pentland series of transformers and chokes have both windings and core totally enclosed in a block of resin. Among the advantages claimed for the method are: greater strength, lower cost, fewer parts and easier assembly, possibility of operation in a wide range of climatic conditions, smaller overall dimensions and lighter weight. The transformers, one of which is shown on page 719, are suitable for incorporation in every type of electronic equipment; they can pass quite remarkable power for their size and, if overloaded, do not exhibit any offensive or dangerous characteristics.

Ferranti also showed a variety of cells, cores, valves and tubes, together with examples of milled-block microwave circuitry.

General Electric Co., Ltd., London, W.C.2.—Only a small proportion of the vast G.E.C. concern is of aeronautical importance, but among the exhibits at Farnborough were an automatic radio compass, servo amplifier units for radar equipment and a radio altimeter. A great amount of communications, telephone, wave-generation and test equipment was also on view, together with a variety of specialist valves.

Kelvin and Hughes, Ltd., Barkingside, Essex.—The range of aviation instruments made by this company is well known, and there was little under this heading that had not been seen before. But it was educational, to those who only go to the S.B.A.C. show, to discover the extent of the company's interests in industrial, marine and medical electronics.

Marconi Instruments, Ltd., St. Albans, Herts.—This Marconi offshoot is chiefly concerned with electronic measuring and testing equipment; available from their stand was the comprehensive catalogue "Telecommunications Test Equipment for the Armed Forces," which includes much British/American conversion references for electronic apparatus.

Marconi's Wireless Telegraph Co., Ltd., Chelmsford, Essex.—On the Marconi stand were representative items of airborne and ground communication sets, aeronautical beacons, including V.O.R. equipment, and a variety of navigational aids. The well-known A.D.200 automatic direction-finder was shown repeating aircraft signals received at London Airport. A Marconi V.O.R. beacon has, incidentally, been calibrated by the American C.A.A., as recorded in this journal on March 27th last.

Metropolitan-Vickers Electrical Co., Ltd., Manchester 17.—A little of the great electronic work done by Metrovick was shown, and of aeronautical significance were airborne interception equipment, mobile early-warning and tactical control radar and its associated target acquisition equipment, and radar trainers. Unfortunately, little may be said of the airborne interception equipment, although this is clearly a most important development.

Mullard, Ltd., London, W.C.2.—There was little of primary aeronautical interest on this stand, but much to intrigue the observer. A radar-sonde system for upper-air measurement was shown, together with such diverse apparatus as: punched-card valve testers, high-power ultrasonic generators for jointing and drilling aluminium or refractory materials, and airborne radio transmitters.

Murphy Radio, Ltd., Welwyn Garden City, Herts. One of Murphy's most important developments is the perfection of a distance-measuring equipment and D.M.E. test equipment. Examples of both were on display, and Murphy Rebecca/D.M.E. equipment was demonstrated in the air to delegates. Murphy D.M.E. Type 1 is the basic equipment, giving range and heading information on a pilot-presentation meter. Type 2 incorporates a time-base unit and cathode-ray tube, for the use of a navigator, while Type 6, for large aircraft, includes the Type 2 displays but incorporates a 3in C.R.T. in a R.C.E.E.A. standard unit which also carries the tube controls, thus enabling the pilot or navigator to make the best use of his own display. Murphy D.M.E. works in the 200 Mc/s band and has an operational range of some 200 n.m.

Other Murphy products shown included airliner passenger announcement equipment and various types of communications sets.

Plessey Co., Ltd., Ilford, Essex.—The Plessey lightweight airborne V.H.F. sets are well known, but the company's stand also housed such items as a frequency-source for calibrating radio equipment, accurate to within 1 part in 10^8, U.H.F. test gear and lightweight revolution counters.

Pye, Ltd., Cambridge.—The company manufactures I.L.S. ground equipment to I.C.A.O. and I.A.T.A. specifications, for the Air Ministry and M.C.A. Other air navigational and blind landing equipment is under development. Pye airport ground-control equipment is actually installed at Farnborough and a set in use at the exhibition was a radio-telephone "trunk-line," the call boxes of which were linked with the M.o.S. in Oxford Street by way of the Hog's Back and Highgate.

Redifon, Ltd., London, S.W.18.—Although such equipment is too big for an exhibition of this type, Redifon are the sole British manufacturers of aircraft flight simulators for civil and military aircrew-training (as opposed to synthetic trainers of a more general nature). Among the types "simulated" are the Comet and Canadair Sabre—the latter being a huge contract won in the face of severe American competition—and it may be assumed that Redifon are developing simulators for some, or all, of our new super-priority military types. The company exhibited a wide range of communications equipment and audio-frequency amplifiers and public address-systems. Among the latter installations may be mentioned a development, first shown at this display, for installation in H.M. aircraft carriers.

In the vehicle park was a typical mobile transmitting station; many other M.F., H.F., V.H.F., D/F., power, workshop, repair, office, meteorological and photographic vehicles are being built for Army and Air Force signals units.

Standard Telephones and Cables, Ltd., London, W.C.2.—The list of aeronautical electronic equipment from Standards is most impressive, including: airfield lighting remote-control equipment, precision-approach radar, V.H.F. automatic triangulation systems, V.H.F. automatic C.R.T. D/F. installations, all types of airborne communications receivers, I.L.S. receivers, radio altimeters, mobile radio systems and air-blast-cooled and miniature valves for airborne sets.

Ancillary equipment includes: crystals, cores, cables, capacitors, thermistors for temperature-control and de-icing in aircraft, SenTerCel selenium rectifiers and other apparatus.

Stratton and Co., Ltd., Birmingham, 31.—This company makes the well known "Eddystone" series of communication equipment which, although not primarily of air interest, enjoys a high reputation.

Ultra Electric, Ltd., London, W.3, revealed a development whose small dimensions possibly helped it to obtain more publicity than any other exhibit. The development was Sarah—or Search And Rescue And Homing equipment. Sarah, the transmitting parts of which are shown on page 719, consists of a miniature beacon transmitter (sewn into an aircrew life-vest, or included in other survival equipment) which emits groups of coded pulses. These are received aboard searching aircraft or ships and displayed on a C.R.T. in conjunction with a fixed vertical trace so as to give a left-right indication for homing purposes. Two-way speech communication is provided "for morale and operational purposes" but is not required for actual location. It may be noted that the Royal Air Force consider the voice provision mandatory.

Once "in the drink"—or on land, for that matter—the survivor pulls the plastic cap off the transmitter and the aerial (a self-erecting, flexible metal tape) springs up. The aerial length is 0.62 lambda, found to be the optimum for land and sea operations. Although very flexible, the aerial can be used in surface winds of the order of 25 m.p.h. or more, and can withstand much rough usage.

The transmitter has two independent valves, one for the beacon and one for voice. The transmission is omnidirectional, with a cone of silence of 30 deg included angle above the beacon. When the airborne receiver receives the first pulse a linear trace is initiated on the tube face. The second pulse is permitted to deflect the trace to one side, depending upon which aircraft aerial has received the signal. Succeeding regular pulses re-write the "spike" in the same place; the time-sharing frequency being about 30 cyc/sec and the group-repetition frequency being some 200 groups/sec, each spike is re-written about 3 times in its half of the time-sharing cycle. A trace is thus produced which can be seen even in full daylight.

When searching, before the reception of any signal, the receiver tuning may be automatically swept over plus or minus two megacycles to ensure that tuning errors do not cause a pulse to be missed.

The transmitting equipment weighs a total of 52 oz and seems to suffer from no environmental limits, as is shown by these data: waterproof to 50ft depth, temperature within −50 to +70 deg C, altitude to 60,000ft, and vibration and acceleration to over 50g. The peak beacon power of some 16 watts is sufficient for a range of 66 miles to 10,000ft, and the accuracy at 500ft is within ± 100ft—considered adequate for all-weather sighting and pick-up. Battery capacity provides for 19 hours of beacon emission and one hour of voice.

One of the most effective ways of employing Sarah is clearly to fit the receiver into a helicopter which can also do the actual rescue work; but in any case, Ultra have sufficient orders for their obviously valuable device to keep them very busy.

Outdoor and Flying Exhibits

Parked in numbered demonstration areas on the airfield were, in company with such items as armoured fighting vehicles and radar-controlled anti-aircraft guns, a Canberra B.2, a Marathon T. and—on the final day only—a Swift F.1. All these aircraft were fully equipped with operational electronic gear and were manned by R.A.F. personnel who demonstrated and explained their complex charges. Also demonstrated on the airfield were Cossor and Ekco airfield radar, Decca navigation equipment and Redifon public-address apparatus.

Foreign delegates were also given the opportunity of flying in suitable aircraft, with service crews, on demonstration flights. The following were the aircraft employed:

Vickers Viscount 700. This aircraft, recently home from Canada, landed at Martlesham Heath before returning to Farnborough. Amongst the equipment on board was: Smiths S.E.P.1 autopilot, Standard Telephones V.H.F. R/T., Standard I.L.S., Standard radio altimeter, Cossor Gee, Sperry Zero Reader, Marconi A.D.F. and Ultra inter-com.

Vickers Viking C.2 of the Queen's Flight, with equipment as above, with the exception of a Marconi communications set and Sperry radio compass. Landings were made with the I.L.S., using Pye transmitters on the ground.

To Defford went two Valettas of Training Command. Each delegate was provided with: Murphy D.M.E., Cossor Gee, Burndept distress transmitter (using a special frequency clear of the distress band), Airmec "Brick" inter-com., and Ekco or Plessey communications sets. The Valettas flew *via* Boscombe Down so that the Murphy D.M.E. could be demonstrated in conjunction with E.M.I. Rebecca beacons, while the landings at Defford used the Standard Telephones Precision Approach Radar.

Avro Anson. Of unspecified Mark, this Anson had a most enormous dielectric nose which presumably housed an Air-to-Surface Vessel scanner. The aircraft went to Southampton Water, where ASV techniques were demonstrated. The set used was principally an Ekco development (it may be remembered that Ekco have long developed cloud/collision-warning sets) although E.M.I. assisted and developed the scanner itself.

Altogether, this was a most satisfying and encouraging display, and it is to be hoped that it will be eventually repeated and, perhaps, opened to workers in the industry which made it possible. In closing, it may be said that it was unfortunate that the exhibition, described by the organizers as "easily the largest and most comprehensive display of electronic equipment held anywhere in the world," should have opened to the Press for less than one hour.

POWER for ULTRA-LIGHT AIRCRAFT

Possibilities of Modern Vertical-twin Motor-cycle Engines Examined

By ALAN BAKER, B.Sc., A.M.I.Mech.E.

EARLIER this year, letters in the correspondence columns of *Flight*, from Lt.-Col. C. E. Bowden, Mr. J. M. West of Associated Motor Cycles, Ltd., and others, served to remind us how badly off we are in this country for light aero-engines. No doubt the lack of interest shown by manufacturers is attributable to such factors as the large number of regulations which hedge-in private flying, its high cost and the manufacturing difficulties which have beset industry of recent years.

The second item suggests the existence of a vicious circle because, surely, the absence of suitable low-cost economical engines contributes considerably to the expense of such flying as is done.

Col. Bowden suggested that the modern vertical-twin motor-cycle engine might well prove a suitable power unit for a light aircraft in view of its relatively low price and weight and its high power-output. This theme merits consideration; and the results of a study of the possibilities are given in the notes which follow.

Modified motor-cycle and even car engines have, of course, been employed for aircraft-propulsion in the past, and many readers will no doubt recall such small motors as the Douglas, Anzani, J.A.P., Scott and Carden-Ford. The majority of them suffered from rather poor power/weight ratio and fuel economy. Since the 1930s, however, developments in design, production methods and metallurgy have effected considerable improvements.

The U.S.A. and certain of the European countries produce quite a number of engines in the 60-80 h.p. range, whilst the smallest British engine in current production is the Cirrus Minor, with a take-off output of 92 h.p. The only other small engine available here is the horizontally - opposed twin J.A.P. of 36 h.p., several of which are still extant. This motor has recently achieved publicity in connection with the Dart Kitten "Make it Yourself" kit.

B.S.A. A.7 Star Twin (497 c.c., 31 b.h.p. at 6,200 r.p.m.).

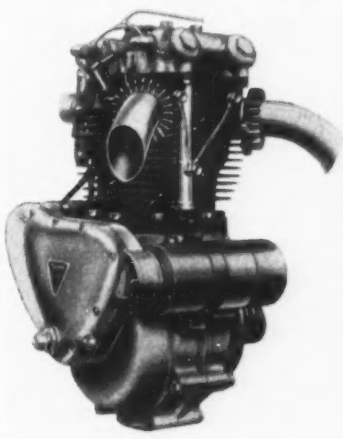
It seems to be agreed that about 40 h.p. for take-off is the minimum desirable to give reasonable performance and power in reserve for normal still - air cruising at about 60 m.p.h. An engine installed-weight in the region of 150 lb should not be excessive. The engine should run on 72 octane (minimum) fuel and should give a cruising duration of, say, 3½ hr.

Table I lists the salient details of motor-cycle engines which could be considered for this type of work, while Table II gives comparable figures for the leading U.S.A. and Continental aircraft engines of 2-3 litres capacity.

Figures of weight, power output, etc., quoted in Table I should be regarded as approximate, because the conditions are not standardized (i.e., it is not known which of the power figures were taken with exhaust silencers and/or air filters; nor have all the makers stated whether the weight includes magneto, carburetter, dynamo, etc.). Official figures for the Matchless engines are not available, but it is understood that the standard G.9 unit gives about 29 h.p. at 7,000 r.p.m.; the same engine with "racing kit" incorporated gives about 38 h.p. at 7,200 r.p.m.; and the G.45 racing engine produces in the region of 50 h.p. at 7,300 r.p.m. All three have a bore and stroke of 66 mm and 72.8 mm, giving 498 c.c. capacity, and the respective weights are 98 lb, 99½ lb (twin carburetters are included in the racing kit) and 101 lb complete.

Before we delve more deeply into figures, some design-details may be of interest. All the units listed are parallel (or 360 deg) twins with the exception of the Vincent, which is a 50 deg vee-twin, and of the Square Four Ariel, which has two 180 deg geared crankshafts. Of the parallel twins, only the Matchless engine has a centre bearing for the crankshaft; the others appear to function perfectly well without one, due to the comparative shortness and stiffness of the shaft.

Crankshafts of these twins are usually steel forgings with a central flywheel, the balance-weights being shared between the shaft and the wheel. These crankshafts may be in one piece with the flywheel bolted to a flange; or they may be divided, each half being attached to the flywheel. An alternative layout is that favoured by Royal Enfield and Matchless, who employ a one-piece alloy-iron cast crankshaft which appears to be equally satisfactory.



Triumph Thunderbird (649 c.c., 33.8 b.h.p. at 6,200 r.p.m.)

Connecting rods are generally of R.R. 56 or similar light alloy, with split plain big-

TABLE 1: VERTICAL-TWIN MOTOR-CYCLE ENGINES

Model	Bore and Stroke (mm)	Capacity (c.c.)	Weight (lb)	Max. Torque (lb in) and r.p.m.	Max. b.h.p. and r.p.m.	Fuel cons. at Max. Torque (lb/h.p.hr)
Norton Dominator ...	66×72.6	497	98	320 (5,000)	29.5 (6,200)	—
B.S.A. A.7 Star Twin ...	66×72.6	497	106	347 (4,550)	31 (6,200)	0.625
B.S.A. A.10 Golden Flash	70×84	646	110	444 (3,550)	34.8 (5,800)	0.70
Triumph Tiger 100	63×80	498	78	332 (4,500)	30 (7,000)	0.50§
Triumph Tiger 100C	63×80	498	72‡	410 (5,900)	46 (7,500)	0.50§
Triumph 6T Thunderbird ...	71×82	649	96	440 (3,500)	33.8 (6,200)	0.50§
Vincent Rapide (Modified) ...	84×90	998	200*	820† (4,700)	65† (5,000)	0.50†
Ariel KHA ...	63×80	498	93	315 (4,650)	27 (6,100)	0.53
Ariel Mark II Square Four ...	65×75	997	130	576 (3,500)	42 (5,400)	0.60
Royal Enfield 500 Twin ...	64×77	496	116	328 (4,500)	26.5 (6,000)	0.60
Royal Enfield Meteor 700 ...	70×90	692	121	477 (3,800)	36 (6,000)	0.60

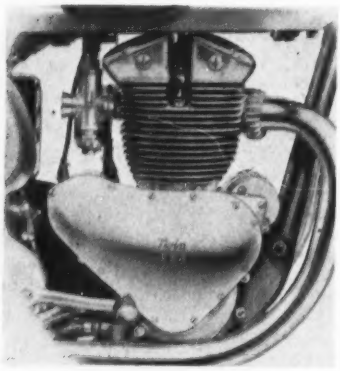
* Includes full screening equipment, large-capacity generator and overspeed governor—engine used for target aircraft. † Power measured at airscrew shaft, i.e. after passing through chain drive and bevel gear. § Average. ‡ Less dynamo.

TABLE II: TYPICAL CONTINENTAL AND AMERICAN LIGHT AIRCRAFT ENGINES

Model	Bore and Stroke (mm)	Capacity (c.c.)	Weight (lb.)	Take-off Rating and r.p.m.	Cruising Power and r.p.m.	Fuel cons. lb/h.p. hr (Rated)
Praga D (Czechoslovakia)	95×100	2,836	148	75 (2,600)	56 (2,400)	0.52*
Walter Mikron III (Czechoslovakia)	90×96	2,440	137	65 (2,600)	48 (2,350)	0.54*
Minié 4.DC.32 (Fr.)	102×91.5	2,980	171	80 (2,610)	75 (2,575)	—
Ambrosini P.70 (Italy) ...	100×92	2,980	172	75 (2,500)	—	0.55
Continental A.65-8 (U.S.A.)	98.4×92	2,800	176	65 (2,300)	55 (2,150)	0.50
Continental C.75-12 (U.S.A.)	103.2×92	3,080	184	75 (2,275)	58 (2,275)	—
Lycoming O-145B (U.S.A.)	92×89	2,370	163	65 (2,550)	—	—

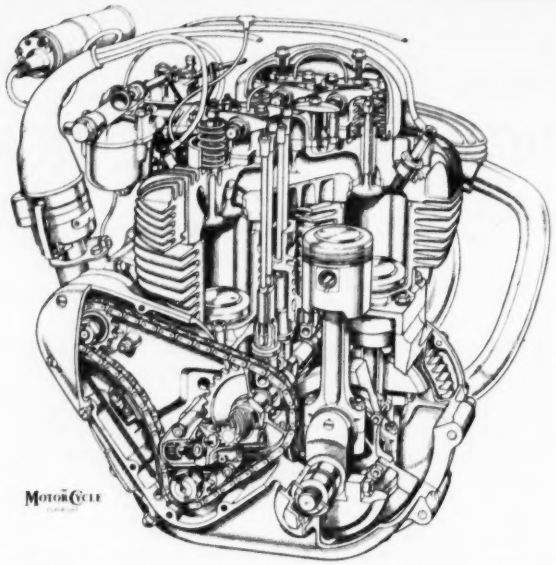
All the above engines are horizontally-opposed 4-cylinder units except the Mikron III, which is a 4-cylinder in-line engine. Fuel employed is 72- or 73-octane rating. * Fuel consumption at cruising power: 0.48 for Praga D, 0.49 for Mikron III.

POWER FOR ULTRA-LIGHT AIRCRAFT . . .



(Left) The Ariel KHA twin, of 498 c.c., develops 27 b.h.p. at 6,100 r.p.m.

(Right) The big Mk II Ariel Square Four, of 997 c.c., produces 42 b.h.p. at 5,400 r.p.m.



ends. White-metal liners may be used, but at least one maker runs the rod directly on the crankpin, using a steel cap with a white-metal liner. Small-ends are usually bushed for cheapness of replacement.

It is customary to use roller bearings on the drive side of the crankshaft and ball or plain bearings on the timing-gear side. Piston design is conventional, the material being cast light alloy, and two compression rings and one scraper are fitted.

All these twin-cylinder engines have hemispherical combustion chambers and overhead valves operated by rockers and push-rods. The camshaft layout varies considerably, some makers preferring a single shaft in front of or behind the cylinders while others use two shafts, one operating the inlet and the other the exhaust valves. Camshafts are installed parallel to the crankshaft axis and may be driven by chain or gears.

A single casting is used for the cylinders and another for the head—except in the case of Matchless and Royal Enfield, who prefer separate castings for each cylinder and head. These two makers employ light alloy for the heads. The Triumph Tiger 100 and 100C have die-cast light-alloy heads and barrels while the Norton Dominator, also available to this specification, employs sand castings. Otherwise cast iron is the standard material for these items. Where light alloy is used, the heads have shrunk-in valve seats, normally of austenitic iron, while the barrels are fitted with pressed-in iron liners.

Rocker boxes are sometimes integral with the head and sometimes bolted on, detachable covers permitting access for adjustment of valve clearances.

An Amal carburetter is fitted to all the vertical twins save the Triumph 6T, which has an S.U. variable-choke instrument. Though not ideal in some respects for aircraft use, the Amal is a cheap and simple carburetter which is not difficult to tune.

Single ignition is the normal practice, and may be either by magneto or by coil.

The Ariel Square Four engine deserves special mention because it is, in effect, two 180 deg parallel twins with the crankshafts coupled by gears. All the bearings are plain except for the drive-side mains, which are of the roller type. There is a single transverse camshaft between the front and rear pairs of cylinders, the valves being push-rod-operated and lying vertically in the head—which, like the block, is a single light-alloy casting. Ignition is by coil and the distributor is in unit with the generator, which is chain driven from the rear crankshaft, the drive also embracing the camshaft. A Solex car-type carburetter is employed, feeding a manifold of X-shape.

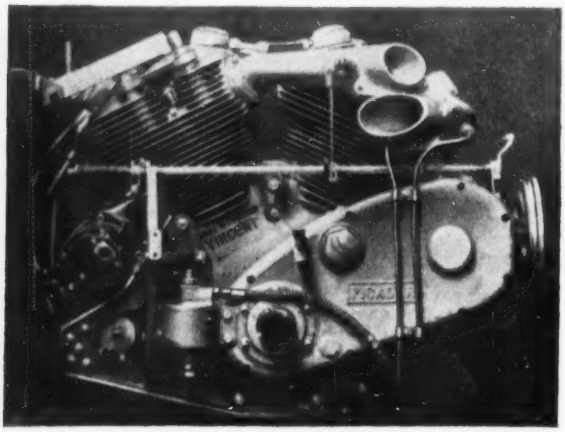
The Vincent engine makes several departures from conventional vee-twin practice. The first unusual feature is that the cylinders do not lie in the same vertical plane; the rear one (as installed in a motor cycle) is offset to the right to improve exhaust-port cooling. As a result, the roller-bearing big ends can be side-by-side on the crankpin without the necessity of offset small-ends. The camshafts are gear-driven and are mounted high in the timing case to enable short stiff push rods to be used to operate the transverse rockers. Cylinders and heads are light alloy sand-castings, the head being in "Y" alloy.

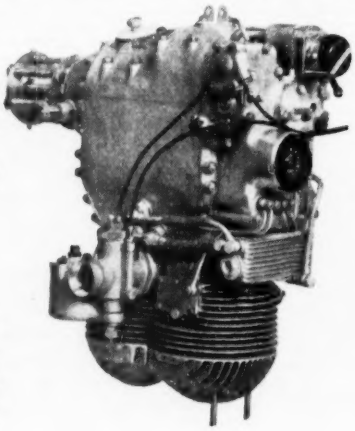
This engine has been modified for use in radio-controlled target aircraft, in which form it is known as the Picador and has direct fuel-injection into the induction pipes, the fuel pump being driven from the airscrew shaft.

It will be noted from the table that the peak r.p.m. of all these engines are well above normal light aircraft practice, on account of the short stroke and low reciprocating weight. Also, the only engines below 1,000 c.c. producing more than 40 b.h.p. in standard form are the fairly highly tuned Tiger 100C and Matchless G45. Whilst these units are designed to give a high degree of reliability under racing conditions, they would naturally require more frequent attention to maintain their tune than would engines of lower rating.

Both of the bigger engines produce sufficient power for our requirements and it is of interest that the performance figures for the Vincent unit were taken with full screening, a large generator and an overspeed governor fitted.

The vertical twin has the advantages of compact and simple design and it should be possible to raise the output of the 650 or 700 c.c. engines to about 40 b.h.p. without appreciable loss of long-term reliability. Alternatively, it might be practicable to use a pair of standard 500 c.c. engines to drive a single airscrew. If a form of free-wheel was fitted to each, either would be capable of maintaining flight, thus providing our old friend "twin-engined safety." In addition, it would be preferable from the economy angle to cruise on one engine working fairly hard rather than two on light load, due to the higher efficiency obtained on larger throttle openings.



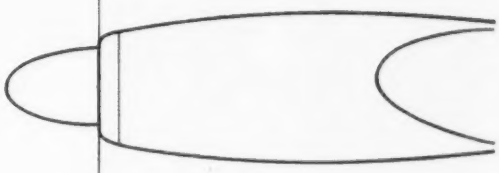


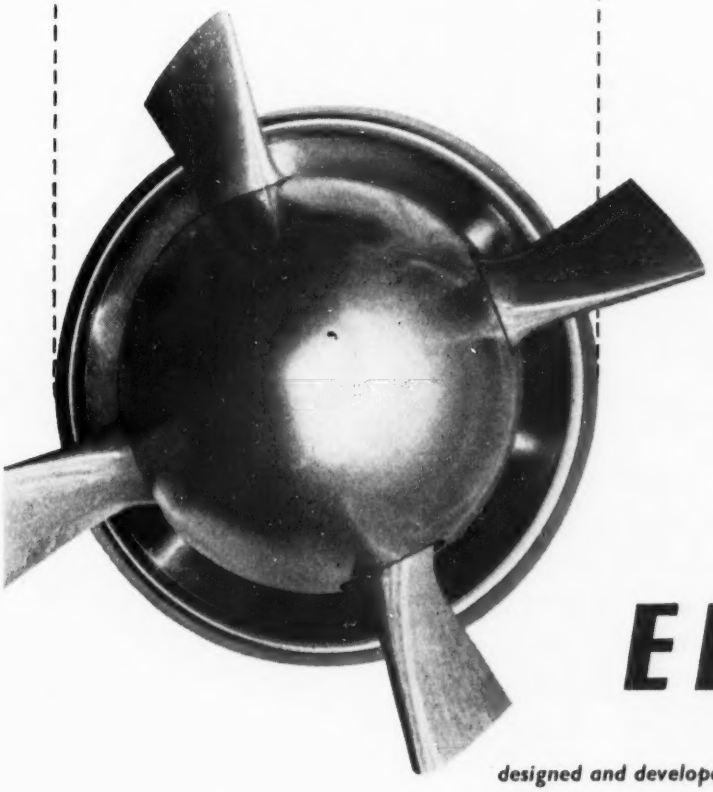
(Left) The vee-twin 997 c.c. Vincent Picador, already in use in a specialized aircraft application, develops 65 b.h.p. at the airscrew shaft. It has direct fuel-injection.

(Right) The famous Scott two-stroke twin was developed in this form for aircraft use before the war. Of 650 c.c. capacity, it developed 28 h.p.

Three thousand e.h.p. in 36"

The economies realised in the Eland design include an appreciable reduction of aerodynamic losses. The cowled diameter of 36" is very much less than has formerly been accepted for this power rating, and power plant drag is correspondingly lower.





Take off rating 3000 e.h.p.
Specific weight 0.52 lb./e.h.p.

Specific consumption 0.48 lb./b.h.p./hr. at 30,000 ft. 350 knots cruising.

Specific consumption 0.452 lb./b.h.p./hr. at 35,000 ft. 400 knots cruising.

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POWER FOR ULTRA-LIGHT AIRCRAFT . . .

With the "paired engines" scheme, about 60 h.p. would be available for take-off and about 25 h.p. for continuous cruising on one engine. However, the weight of the pair would be in the region of 200 lb, which is on the high side, though not a great deal more than the Vincent would scale if shorn of its generator, etc. From the weight aspect, the Ariel Square Four is a good proposition, though its power output would be less than that of the paired engines.

When this article was originally discussed, the intention was to suggest direct vee-belt drive from crankshaft to airscrew shaft with, say, a 2:1 reduction in order to give an efficient airscrew speed. Vee-belt transmission offers the advantages of a "soft," silent and inexpensive drive, and one requiring no lubrication and no special enclosure. In the view of the belt manufacturers, however, the engine speed is rather too high for a direct vee-belt drive to be a satisfactory proposition for this particular duty.

The alternative airscrew drives are by gears or chain and the former would certainly be expensive if done properly. If correctly adjusted and lubricated, the chain might, on the basis of its performance on motor cycles, be reasonably expected to last upwards of 500 hours. Either of these arrangements would complicate matters by requiring enclosure and lubrication and, apart from the cost, would provide a less resilient drive.

A possible compromise would be to use the existing motor cycle primary chain drive, with its oil-bath case, to a countershaft, and to drive the airscrew by belts from the latter. The primary reduction is normally about 2:1, so that a 1:1 belt drive would give maximum airscrew r.p.m. of about 3,000 for any of the untuned engines. Some means of tensioning the belts, either by direct centre-adjustment or by adjustable jockey pulleys, would have to be provided. One of the leading manufacturers of endless vee-belts considers that five belts of 21/32in section should transmit up to 30 h.p. at the desired speed on pulleys of 8in diameter, the overall width of the pulleys being about 3¼in. This firm points out, though, that such a drive is outside the normal scope of vee-belts and so any responsibility for its behaviour would rest with the experimenter.

The Vincent Picador has a chain primary drive to a pair of bevel gears which turn the drive through 90 deg, the overall reduction being 2:1. The airscrew is directly mounted on the output shaft of the bevel box. It will be appreciated, however, that the aircraft concerned is not one where low first cost is vital, and such an arrangement would certainly not be cheap.

Certain modifications would have to be made to any of the motor cycle engines to make them suitable for aircraft work. Dual ignition is regarded as highly desirable and the valve-gear layout on some of the engines is such that fitting a second plug would not be too easy. Since no generator would normally be required, the second magneto could be mounted in its place on the magneto-ignition engines and the drive altered to suit. The coil-ignition engines could probably be adapted with little difficulty to take a magneto of the dual type. Polar-inductor magnetos are now available for racing motor cycles so it might be possible to obtain a pair of these if they are preferred to the rotating-armature variety.

The possibility of operating under icing conditions suggests that some form of flame-damped intake drawing warmed air from the back of the engine would be advisable.

Apart from the question of vee-belt adjustment, one of the installation difficulties of the motor cycle engine would be that of vibration, the unbalance characteristics of the vertical twin engine being very little better than those of the single-cylinder unit. The mass and rigidity of the motor-cycle frame (which has to be robust enough to cope with road shocks) absorb much of this vibration so that the residue transmitted to the rider is rarely uncomfortable. In an aircraft, however, the weight of the engine sub-frame is important, and a rigid mounting is likely to transmit too much vibration to the main structure. A reasonable degree of flexibility should not prove troublesome, provided that, for example, it did not affect the belt tension; so a resilient mounting on car lines could provide the answer.

The question of overhaul periods must be considered and, for economy of maintenance, it is felt that 250 hr should be the minimum between complete overhauls. This represents something like 20,000 road miles on a motor cycle but in conditions more generally favourable to the engine. The major components of the standard motor cycle engines—e.g., main and big-end bearings, cylinders and pistons—should stand up to this without any difficulty. However, a top overhaul (to include decarbonizing and valve-grinding) should be carried out at least at the half-way stage. Also, a check of the ignition side would be advisable not less frequently than every 50 hr.

The foregoing remarks would apply only to the "untuned" engines, and it is doubtful whether the greatly increased loadings of the racing versions would give satisfactory performance of the major parts over so long a period.

Turning now to the airframe, a suitable type appears to be a single-seater or tandem two-seater, since either would provide the necessary small frontal area and appropriate shape for a motor cycle engine. The compact layout of the vertical twins would enable two to be accommodated side-by-side without occupying more width than the occupants of the aircraft. If located with their crankshafts fore-and-aft, incidentally, such engines would require a system of air ducts and baffles to ensure efficient cooling of the rear cylinder.

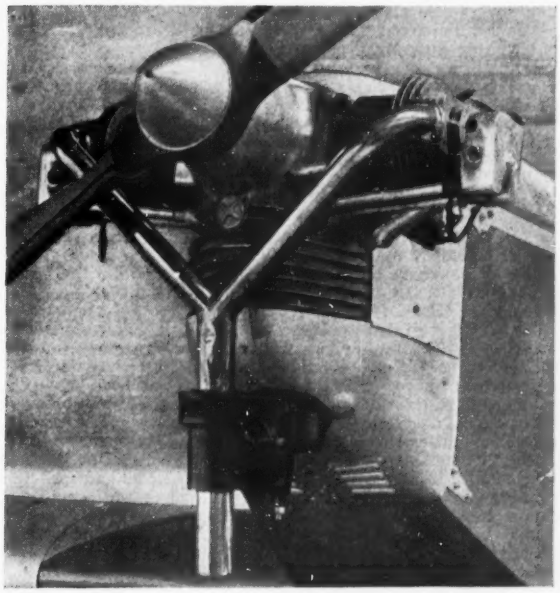
If the shaft was arranged appreciably above crankshaft level, an airscrew diameter of about 5ft could be accommodated with adequate ground clearance.

It has been said that, if such an aircraft could be sold complete for under £500, there might be an immediate demand for about a hundred; but considerations of economical production suggest that it might be more realistic to consider the converse, viz., if a guaranteed demand of 100 or more exists, would it be possible to produce the aircraft for under £500?

The basic price of a standard 500 c.c. vertical-twin engine with carburetter and magneto would be in the region of £75 to the general public, and presumably an aircraft manufacturer would pay appreciably less.

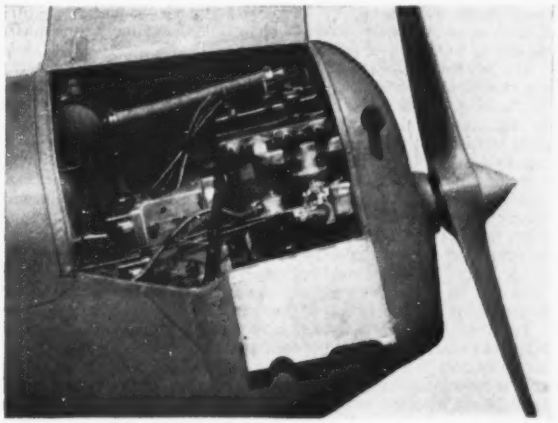
The necessary modifications might be expected to add £20 or more on to this figure, so that a pair of engines should run out at not much over £150. Their availability is not known but it is thought that it should be satisfactory.

Fuel consumption under cruising conditions would not exceed



(Left) The J.A.P. aero flat twin, of 40 h.p. for take-off, was installed in pre-war light aircraft, including the Aeronca.

(Below) The Carden-Ford—a modified 10 h.p. Ford car engine—has powered several successful light aircraft, notably the Chilton.



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2 gallons an hour, so that a tank of 7-8 gallons capacity would be ample for normal requirements. To reduce costs it might be possible to incorporate the tank from one of the popular light cars, these being usually of about the capacity mentioned. The use of standard components is obviously desirable in every possible instance in view of the stress on low cost.

In conclusion, the possibilities may be summarized as follows:—

(1) There appears to be no essential objection to the use of high-output motor-cycle engines for light aircraft, although certain manufacturers of such units are not very keen on the idea.

(2) The Vincent and Square Four Ariel 1,000 c.c. engines produce sufficient power in their present form.

(3) Two of the 500 c.c. vertical twins also do so, but are considered to be too highly rated for reasonable service between overhauls.

(4) The standard 500 c.c. engines give less than the minimum advisable power output, but two side-by-side would be a reasonable proposition as regards power.

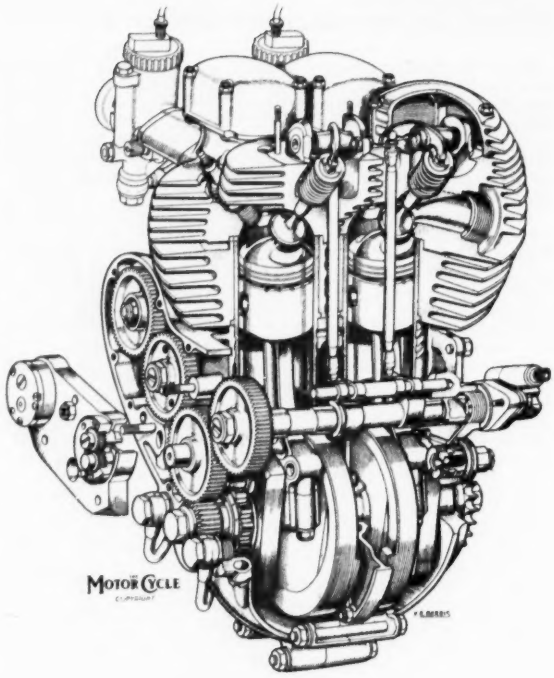
(5) The 650 and 700 c.c. twins are rather "betwixt and between" but with mild tuning could probably be induced to push out about 40 b.h.p. without serious effect on longevity.

(6) Belt drive to the airscrew would be worth trying if a 2:1 primary reduction by chain could be embodied.

(7) Dual ignition would present a problem in the disposition of the second sparking plug.

(8) Flexible mounting of the engine would be desirable in order to absorb vibration.

(9) To keep the aircraft-price below £500 all in, the scale of airframe-production would have to be sufficiently large to keep the cost of the airframe below £350.



One of the more powerful post-war motor-cycle units is the 500 c.c. Matchless G.45 racing twin. Power figures are not available, but it is believed that some 50 h.p. is developed at 7,300 r.p.m.

"VICTORY AT SEA": THE FINISH

APTLY entitled *Suicide for Glory*, episode 25 of the B.B.C. television film, *Victory at Sea*, dealt almost exclusively with the Kamikaze tactics against Allied shipping during the attack on Okinawa, the last link in the long chain of islands taken in the advance on Japan. It is difficult for Western minds to comprehend what these flights really meant. They were not "suicide attacks" in the general meaning of the term : they were essentially a religious rite, and the pilots derived glory from them. Included in the film were Japanese newsreel shots of a number of these fanatical young pilots participating in religious festivities before taking off on their macabre one-way missions. Their Zekes (Navy 0) were fitted with either underwing tanks or bombs.

The Allied invasion armada totalled nearly 1,500 ships of which over 300 were warships. The transports carried over half a million men—for the capture of an island little bigger than the Isle of Wight! Kamikazes were virtually the sole method used in opposing this mighty amphibious force, and ships their sole objective. Some 3,500 were used, according to the film commentary, another source gives 1,900 Kamikaze attacks out of the total of 3,000 Japanese aircraft lost during the campaign. The Kamikazes hit 279 ships; in other words, only 14.7 per cent of the attacks were successful.

The dreadful damage caused by these crashing aircraft was most vividly portrayed. Kamikazes that could be identified included Bettys (Navy 1), Zekes (Navy 0), and Vals (Navy 99), and many spectacular hits on U.S. carriers and warships were shown. Shots were also shown of Corsairs being flagged off for anti-Kamikaze patrols; and there was one of a Hellcat, about to take off, exploding in a flash of flame.

Desperate measures were taken to counter the menace. Okinawa was ringed with 100 destroyers equipped with early-warning radar. At the height of the attacks the defence could call into action over 600 fighters and 7,400 anti-aircraft guns. The ship-mounted A.A. guns were the last line of defence, and many exciting sequences of the hail of shells hurled at incoming Kamikazes were shown, including some taken during night attacks.

A special SOS for spare 20 mm and 40 mm gun barrels and for shells with proximity fuses was sent. In far-off Britain development work intensified on the Fairey Stooge, a guided missile designed for use against Kamikazes. Fortunately, these were not needed for, as the bitter fighting on Okinawa continued, the Emperor of Japan was already issuing private instructions for negotiations for the ending of the war.

Had the Allies known this, it is possible that Hiroshima and Nagasaki would have been spared the atom bomb, dropped with the intention of making an invasion of the mainland unnecessary and so saving the lives of Allied servicemen. Some of the desolation caused by these bombs was depicted in *Design for Peace*, the last episode of the film. The remainder of the episode was devoted to the homecoming of servicemen of the varied Allied nationalities.

And so, after six months, ends one of the most exciting films ever made. The film had its faults and inaccuracies—but then what 13-hour film would not? Its accent was mainly American, because more ships and men were involved in the Pacific than anywhere else, and these ships and men were preponderantly American. The producers maintain, however, that an honest effort was made to portray the British and other Allied contributions to the general victory, and epics like the Battle of Taranto and the sinking of the *Bismarck* were not shown "because no satisfactory footage was available on these actions." On the whole it was undoubtedly a most praiseworthy attempt to present contemporary history in a novel and dramatic manner. Spotters had the time of their lives and many shots of interest to the air historian were shown, particularly those from Japanese and German cameras. These gave one the impression of being privileged to see some of the things that happened behind the scenes and enemy lines during these momentous years.

But such scenes as the shooting of Japanese soldiers swimming ashore in *Two if by Sea*, the execution of Chinese shown in *The Road to Mandalay*, and the glimpse of an Okinawan child shaking with fear in *Suicide for Glory*, make one hope that never again will there be the material for an epic like *Victory at Sea*.—M. F. A.

THE REDUNDANT INSTRUCTORS

A FURTHER statement on the position of flying instructors displaced by the closure of flying schools was made to the House of Commons on May 20th by Mr. George Ward, Under-Secretary for Air, in reply to W/C. E. E. Bullus (Con., Wembley North).

He said that to date 50 instructors had been offered appointments in the R.A.F. as pilots, with a further 22 commissions in the ground branches. About 30 more had received offers of employment as civil pilots. Arrangements had been made in conjunction with the Ministries of Labour and Civil Aviation that, where such offers depended upon the instructor's obtaining additional qualifications, financial help would be given to him during his training course. Many others had found posts elsewhere and had been given all possible assistance and advice.

Inevitably there were cases where instructors had not so far found alternative employment. Some of these had applied to the R.A.F. Benevolent Fund for help and the Air Council had made a special grant of £2,500 of R.A.F. prize-money in recognition of what the Fund was doing for them.

FAIREY GANNET

More than ever before Seaborne and Airborne elements are interdependent. The Royal Navy is constantly developing new weapons and new techniques to retain superiority. To attack with these new weapons and develop new methods of keeping the sea lanes clear the Fairey Gannet anti-submarine aircraft has been ordered for the Royal Navy. It has also been ordered for the Royal Australian Navy.

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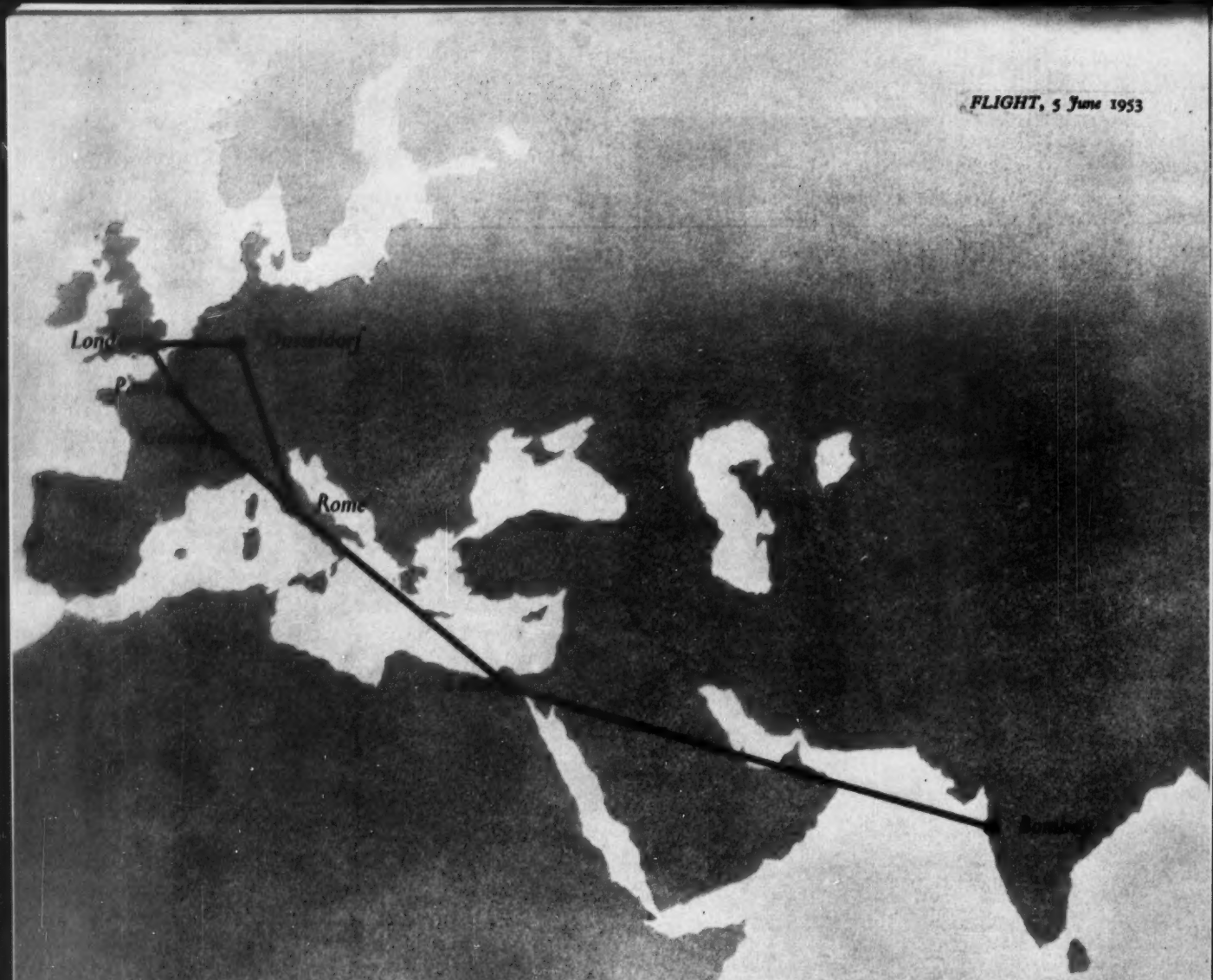

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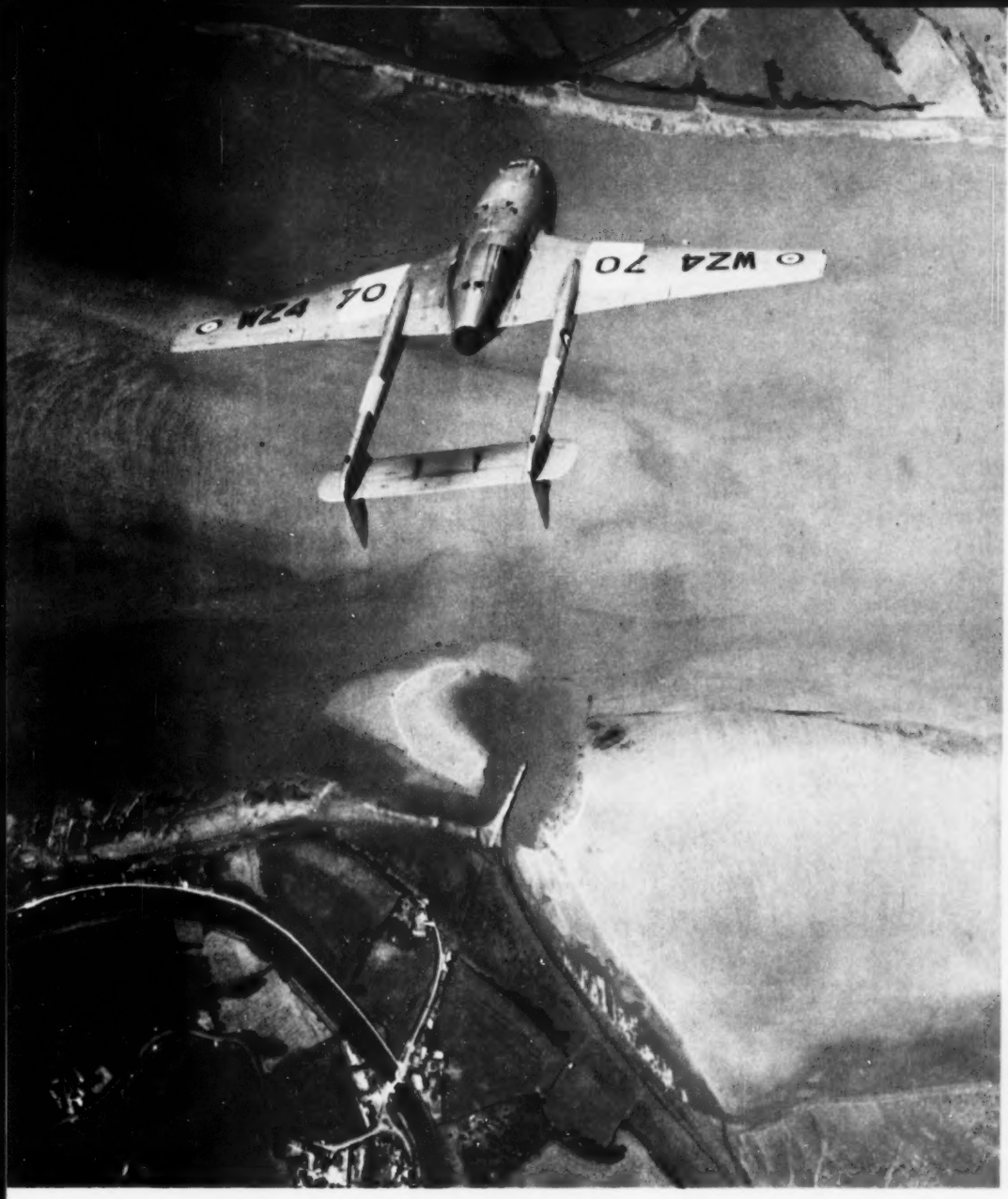
ROLLS-ROYCE Avon engines

DH AIRCRAFT



JET-TRAINER TRIO

VAMPIRE T.11s IN THE COLOURS OF THREE AIR FORCES

***ELEVEN** air forces have chosen the de Havilland Vampire T.11 as a standard jet trainer, among them the Royal Iraqi Air Force (left) and Royal Swedish Air Force, whose colours are carried by the two examples below. An R.A.F. T.11 is the subject of the striking study above, secured by an Air Ministry photographer during a formation loop.*

The end of the line: nearly completed Canberras in various stages of final assembly.

The Canberra

UNDER CONSTRUCTION AND IN THE AIR

ON a recent meteorologically unpromising morning, a small party of visitors—of whom the writer was one—assembled at Hendon at the invitation of the English Electric Company, with a view to inspecting the company's factories and airfields and sampling a trip in a Canberra. The weather was indeed appalling, but after a short delay the firm's Dove appeared beneath the lowering clouds, in the capable hands of Jock Still, and soon we were on our way north-westwards through pouring rain and remarkable turbulence. Conditions improved the farther north we went—as our geographically-biased pilot assured us they would—and over Manchester the sun came out. It seemed to be, and was, a good omen for an instructive and illuminating visit that was to impress those concerned with the energy and drive that are being put into the task of supplying the R.A.F. with up-to-date bomber aircraft.

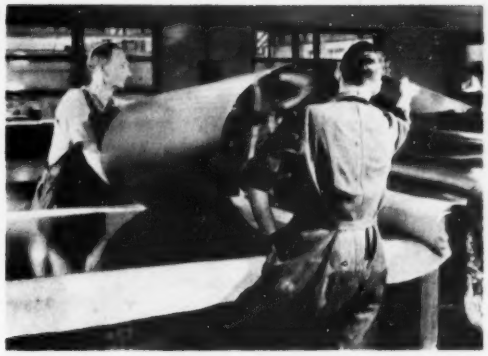
The English Electric group is a very much larger concern than is perhaps generally known. Not only do they make aircraft, diesel-electric locomotives, steam and gas turbines, water turbines and generators, refrigerators, washing machines and many other products, but, in addition, the Napier and Marconi companies are part of the organization. On the aircraft side, production has been in progress continuously since 1938, and during that time 800 Hampdens, 2,500 Halifaxes, 1,400 Vampires and (judging by recent air exercises) well over 100 of their own Canberras have been turned out.

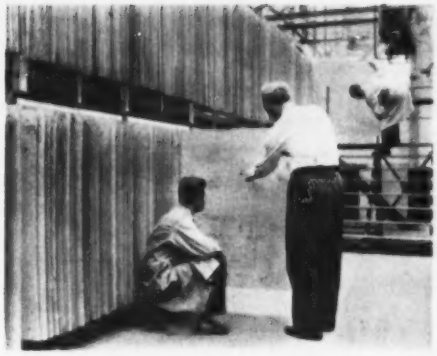
Chairman and managing director of the whole group is Sir George Nelson, F.C.G.I., M.I.Mech.E., M.I.E.E., F.R.S.A., and the aircraft part of the concern is divided into three sections. Design and all experimental work, both flying and constructional, are at Warton, a few miles west of Preston, and here F. W. Page is chief engineer and designer, with D. L. Ellis, F. D. Crowe, A. E. Ellison, J. C. King and R. F. Creasy as key men in his team. On the flying side W/C. R. P. Beamont, D.S.O. and Bar, D.F.C. and Bar, D.F.C. (U.S.A.), is chief experimental test pilot, assisted by F/L. P. D. Hillwood, and with S/L. D. A. Watson as staff navigator.

The manufacture of all components—other, of course, than engines, tyres, wheels, brakes and a few other items, plus a certain number that are sub-contracted—is carried out in Preston itself. Here A. Sheffield is general manager, W. Shorrock works manager and W. Harpley works superintendent. The first two of these supervise locomotive as well as aircraft manufacture, and the contrast between the two types of engineering is most interesting to see. Mr. Harpley is the top man concerned exclusively with aircraft production, and he is also in charge at the third factory, which is at Samlesbury (pronounced "Sarmsbury"), just east of the town. Here the various Canberra assemblies that have been constructed at Preston are united, and the completed aircraft production-tested before delivery to the R.A.F. and other purchasers. A. Ainsworth is superintendent at Samlesbury, and production testing is carried out by J. W. Still and by J. W. C. Squier, chief production test pilot who, incidentally, added to the enjoyment of our visit by a fine demonstration of the aircraft's capabilities. To complete the personnel story, the aircraft division in London is headed by A. Cdre. Strang Graham, who is assisted by J. W. Adderley and R. M. Milne, with W/C. R. Stanford-Tuck D.S.O., D.F.C. and two Bars, D.F.C. (U.S.A.) stationed at Warton.

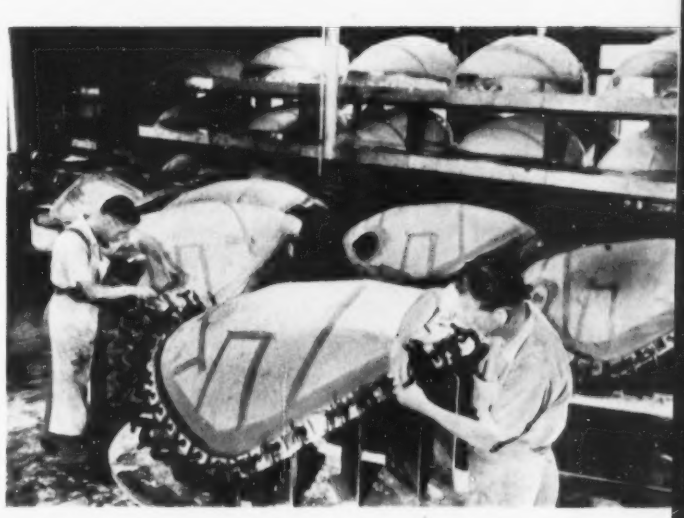
Turning now to the more material side of the picture, at Warton we first saw the various drawing offices. No paper blueprints are used, except for experimental work. Instead, a thin aluminium alloy sheet is used as the base for each drawing, which then becomes a "master" and is permanently stored. From this master, by an ingenious process involving an intermediate gelatine plate, a roller and fine brass dusting powder, silver-line reproductions can be made on further aluminium sheets. These sheets are coloured blue, green or other shades to indicate destination, and are used instead of the normal blueprints. This loft-plate system possesses several major advantages. The drawings never become rumpled; measurements can be taken directly from them; and portions can be cut out and used as templates. The use of the system has not only assisted production at Preston, but has also enabled the aircraft turned out by Handley Page, A. V. Roe, Short and Harland, Glenn L. Martin and the Australian Government factory to exploit component interchangeability to the full.

Amongst the test-equipment, which is unusually complete, is a cold-chamber in which Perspex canopies and other plastic or metal components are tested for resistance to load or fatigue.





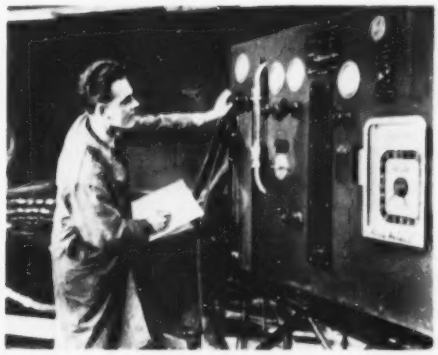
(Above) Rolling back a loft-plate which has just been "printed" from a master by using a gelatine plate—seen on the table—as an intermediate stage. (Right, above) Examining a master in the loft-plate store. (Right) Perspex canopies being assembled at Preston.



The success of the canopy design and construction achieved with the aid of this and other equipment can be judged from the fact that only one failure has occurred in the air in 30,000 hours' flying. Other devices include a rotatable fuel-test rig, a structural-test frame, a large conventional wind-tunnel, a water tunnel, and —particularly interesting—an unusually economical transonic wind-tunnel. This is twelve inches square in cross-section, and flow of air is created uniquely by positioning the tunnel as part of the intake of a Nene engine made available by Rolls-Royce, Ltd. This system has enabled smooth airflow to be obtained at an attractively high Mach number.

Activity at Preston can best be described by saying that the production line *looked* like a production line, and that the factory workers gave the impression of getting on with the job, and of being interested in it. The number of British machine-tools in use was encouraging, and our guide spoke highly of them. Some

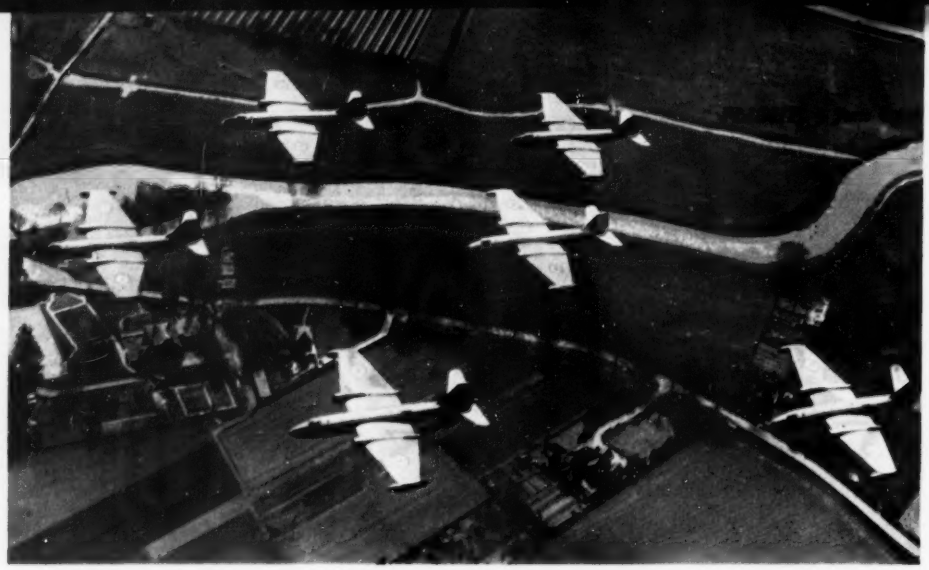
(Below) The transonic wind tunnel: the operator on the left is examining the working section, whilst a colleague in the control room is ready to adjust the Nene's power lever. (Below, right) The control panel of the fuel test rig, by means of which complete fuel systems can be checked under simulated conditions of flight.



American and Swiss units were in evidence, too, and one of the latter particularly caught the eye—a jig-borer that can work to one part in a million with a skilled operator. Another interesting machine was the huge rubber press, which can mould in five seconds a set of components that would take a competent tinsmith more than a full day. And out at Samlesbury were stretch-forming machines which could similarly save hours of skilled labour.

So much, then, for a brief glance at the production side of the picture. Let us now look at the aircraft itself. An Air Ministry specification was issued in 1945 for a medium-range bomber relying solely on speed and altitude for defence. English Electric and Rolls-Royce, working in particularly close harmony, decided that the specification could not only be met, but exceeded, and so the Canberra design was born. Chief designer at the time was W. E. W. Petter, who remained at Preston until nine months after the prototype's first flight. The whole idea was to evolve a relatively simple, cheap aircraft *quickly*, so that a whole fleet and not just one or two prototypes could be produced at once. The success of this policy may be judged from the number of Canberras which took part in the recent Exercise Jungle King. Put in another way, the policy was to create an aeroplane that was "the extreme in adventurous conventionalism"—to quote a phrase used by Mr. Page. Impetus was given to the proceedings by the fact that at the beginning of 1945 the Germans had jet aircraft in service in far larger numbers than we ourselves, including a successful reconnaissance jet bomber, the Arado 234; but difficulties also existed, notably in that little money was available for armament purposes once the war had ended, and that there was no suitable engine for the proposed airframe. Monthly meetings between the two companies, however, allowed the engine and airframe to grow up together, and when the prototype flew the one acted as flying test-bed for the other, because no other suitable aircraft existed which could achieve the requisite height and speed.

Work proceeded apace, and the first flight referred to above took place in May, 1949, with W/C. Beamont at the controls. The Avon engines were incompletely developed and de-rated, but performance and handling characteristics surpassed all expectations. The



Into service: Canberras, in various camouflage schemes, from R.A.F. station Binbrook.
"Flight" photograph

The Canberra . . .

aircraft was superbly—almost historically—demonstrated at Farnborough in September of that year, and by December had been joined by three other B1s, as this mark came to be called.

An initial production order had been received much earlier in the year, and as time wore on and the international situation deteriorated, further orders were received and impetus was given to "stretching" of the design, leading to a number of marks of increasingly great potential.

It will be convenient at this point to outline the differences between these versions of the basic aircraft, in so far as security permits: five marks may be mentioned at the present time. These are as follows :—

B.1 Two-seat radar-equipped bomber, built to original specification.

B.2 Three-seat bomber at present in full production at four factories in England. Prototype flew in July 1950. Ceiling and range are very considerably in excess of those in the original specification.

P.R.3 Two-seat photographic-reconnaissance aircraft, now in production. Several cameras can be fitted. It was the prototype P.R.3 that F/L. Whittington recently flew out to Australia in record-breaking time.

T.4 Three-seat dual-controlled trainer, now in production. The prototype flew in June 1952.

B.5 Target marker version of the B.2 incorporating several new features to improve the all-round performance. A B.5 was used on the double Atlantic crossing last year.

B-57A American night-intruder version being built by Glenn Martin.

B.20 The Australian-built version.

As far as the American order was concerned, General Boyd and his party spent ten days at Preston during the successful assessment trials, and English Electric subsequently despatched seven tons of loft-plates and other items of information by Skymaster to Martins.

Test flying at Warton and Samlesbury has been a full-time job. Warton is the master airfield, equipped with Marconi AD.200 V.H.F./D.F., and an account of some of the problems associated with production test-flying, written by one closely associated with such work, follows this article.

One-and-a-half hours' continuous flying is sufficient to test out a production aircraft if all goes perfectly from start to finish but, naturally, several flights are frequently necessary. A final flight is then always required for every aircraft in order to check behaviour with wing-tanks fitted. The aircraft are delivered with these tanks, and after that it is up to the "operator" to decide whether to use them or keep them in store.

Production test-flying, as already explained, is carried out from Samlesbury, using navigational techniques explained by W/C. Beamont in the account already referred to. Experimental test-flying is also proceeding all the time, from Warton itself; it covers all the usual aspects, such as ironing-out snags, testing new equipment, endeavouring to raise limitations, trying out new control surfaces, and so on. The programme has been a great success, as witness the greatly improved performance of the latest marks of Canberra. Long-distance flights have been a feature. The proving trips for the double Atlantic crossing involved, in one case, a quick return journey to Reykjavik, and in another a round trip over a route *via* the Scilly Isles, Manston, and the Shetlands.

One point particularly investigated has been that of misting up after rapid descents. The normal cabin heating-cum-ventilation system, in conjunction with the double skin of the Perspex canopy, has proved entirely satisfactory for any conditions that the test pilots were able to locate, but R.A.F. personnel—including F/L. Whittington when he was *en route* to Australia—have occasionally had trouble after rapid descents from great heights in the tropics, when humidity has been high. A minor modification has proved fully effective in curing this trouble.

Airborne in the T4

So far, then, our visit had given us a fairly comprehensive but more or less theoretical impression of the Canberra : practical experience is always essential in order to form a balanced picture, and we were fortunate enough to be offered a trip in the prototype T.4 trainer flown by Peter Hillwood. On arrival at dispersal, with the sun streaming down from a cloud-flecked sky, my colleague for the occasion entered the aircraft first, and was duly strapped into the seat behind the pilot, thus filling the rôle of the future u/t navigator if and when carried. Hillwood entered next, so as to conduct the preliminary cockpit procedure, and finally I climbed in myself, and took up position in the right-hand or instructor's seat.

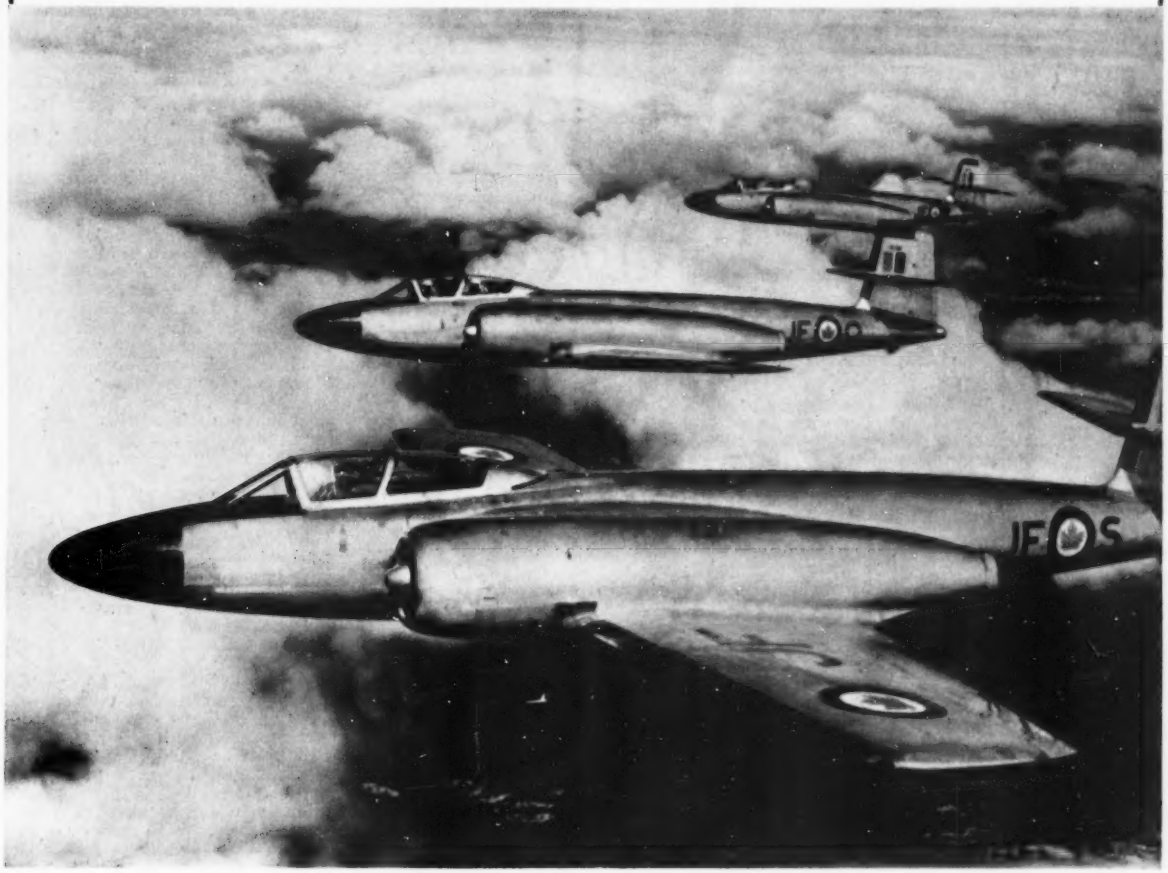
Soon the strappings-in were completed, and it was possible to take a look round the cockpit. View seemed excellent in all directions, notably forward over the nose, and there was a small circular direct-vision panel for each pilot. The controls and engine instruments were well laid out and few in number compared to those of a comparable piston-engined aircraft. Ventilation of the cockpit was derived from a number of punkah-louvres located at strategic points in front of the pilots. The general set-up for both pupil and instructor, indeed, seemed highly satisfactory, and there was comfortable room for two quite large men to sit side-by-side.

Further rumination on this score, however, was cut short by the pilot, who signified that he was about to start up. The process seemed to be ridiculously simple. A touch of a button fired a cartridge, the starboard Avon started to spin, the igniter switch was held in till sufficient revs had been obtained, and that was that. Soon both engines were idling contentedly, giving out that familiar combination of scream and boom that delights the hearts of onlookers at Farnborough every year, and the ground-crew were quickly waved away.

Permission to taxi was requested, and rapidly received, from Control, and a moment later we were moving smoothly down the perimeter track to the take-off point, the nose of the aircraft waving gracefully up and down as we crossed the occasional bump. I tried out the taxying myself, and found no trouble : the brakes provided very agreeable control of direction. A very few minutes more, and we were facing down the runway, ready for take-off.

As always with jets, there was no running up or prolonged cockpit procedure : a few essential checks, an opening of the engines to moderately high revs on the brakes, and away we went. And how we went ! The acceleration fairly hit us in the back; maximum permissible r.p.m. showed on the tachometers and, almost before there was time to breathe, take-off speed was registering on the A.S.I. and the machine was straining into the air. Wheels came up with a rush, speed was allowed to

In Canada ★ AVRO C.F.100



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The Canberra . . .

build up to a surprisingly high value, and we started our climb. When making a climb in a Canberra, forward speed is so high that one is not quite prepared for the extraordinary rate of climb that goes with it.

Security, alas, prevents quotation of the actual figures for our initial ascent, but suffice it to say that, with r.p.m. not far short of the maximum showing on the counters, we were a long way above Everest height in a very short space of time. It was an astonishing sensation. Noise was very limited, and wings and nacelles were invisible unless one looked round for them. The little cockpit with its three occupants and rows of tell-tale dials seemed quite isolated from the world, rushing upwards without any apparent means of propulsion.

Once at the desired height, Hillwood throttled back by a few hundred r.p.m. and we had time to look round. I had already sampled the controls during the climb, and was able to do so again at this point finding them very agreeable to operate.

What other impressions did one form in this strange world just below the tropopause? The sky was unusually blue, and it was intriguing to look down, for a change, on a patch of flimsy cirrus cloud. There was a clear horizon, but it was much lower down than is normally seen, and maintaining height in a turn was appreciably more difficult than usual: one's eyes strayed continuously to the blind-flying panel for confirmation of visual impressions. Way below, familiar Squire's Gate Airfield could be seen, and there was Blackpool Tower, for all the world like some child's toy. In the cockpit the cabin-altitude indicator showed that the pressurization system was working in the way that it should, and through our masks came the indefinable smell of fresh oxygen passing through rubber hose.

For a few minutes we looked around, and generally behaved like tourists in a new country. Then came the time for sterner stuff—the moment to investigate the behaviour of our mount as her speed was raised towards critical Mach number. For obvious reasons the actual number cannot be quoted, but it is high—extremely high, in fact, for an aircraft with a non-swept wing. Somewhat below the critical figure, a gentle, rather rapid vibration set in, of a kind which can be endured indefinitely by crew and structure alike without discomfort—indeed Beamont, Hillwood and Watson cruised at this condition on the return half of their Britannia-Trophy-winning flight last year. As speed was increased by diving slightly this vibration increased. More speed still produced a slower, harsher buffet, then porpoising with a small nose-down tendency. Just below the critical figure this tendency evened itself out, with pronounced, severe buffeting, and finally the nose came uncontrollably but safely up. Our well-trained steed had eradicated the cause of the trouble by slowing down. Apart from this docility at high Mach number, other points which came to mind at this time were the ceiling of the Canberra, which is over 50,000ft; its manœuvrability at extreme altitude; its ability to hold a high angle of climb if required; and its very large speed range. All these advantages accrue from the policy of building an aircraft with a moderate wing loading, as has often been proved emphatically in the past, albeit at lower altitudes.

To return to our flight. The next move was to carry out some descents, and for this purpose the airbrakes were used. At high altitudes they are as effective as required for a bomber, though they do not produce the pronounced retardation of those, say, on a Meteor. The effect nearer the ground is more marked. Using the airbrakes we came down quite rapidly, and it was interesting to compare the readings of the A.S.I. and the Machmeter at different altitudes.

Soon we were down to 4,000ft or so, and for a few minutes I was allowed to indulge in an old favourite pastime, that of playing hide-and-seek with the tops of broken cumulus clouds—much to the consternation of my colleague in the back, who could see little and feel much. Then over to Hillwood again, and we performed an effortless barrel roll—such a smooth, graceful performance, with no trace of positive or negative g. The subsequent half-loop and roll-off-the-top was very different in its effects on us. Such climb from cruising speed seemed utterly fantastic, often as one had seen it or heard of it from some vantage-point on the ground.

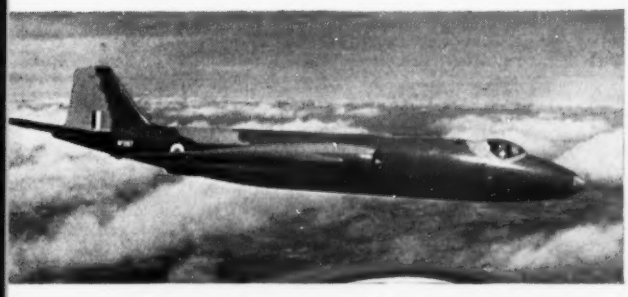
Next phase of the demonstration was the stall. At 10,000ft and 320 kt both engines were throttled back and the control column was operated so as to maintain height. Slowly—very slowly, because of the clean lines of the aircraft—the reading of the A.S.I. dropped back and back. Noise became less and less. We seemed poised above the earth in an uncanny near-silence. Then at last Nature had her way: the nose dropped slightly, without the faintest sign of wing tilt, and speed increased. An elementary trainer would be proud to share the stalling characteristics of this race-horse of the skies.

And so, reluctantly, we looked at our watches and saw it was time to go home. Airbrakes were used, with throttle reduction, to reduce the speed to that permissible for undercarriage lowering. Down came the wheels, and the little green lights shone out their friendly confirmation. We lowered the flaps, and started the turn in. By this time the runway and a glorious setting sun were ahead; speed was gradually tailed off as we approached the hedge. Both throttles were pulled right back, and we crossed the end of the runway. In so clean an aircraft, float was, naturally, appreciable; but after a pause we touched down, mainwheels first, then nosewheel, and by way of concluding his demonstration Hillwood put on the brakes, gently at first, then firmly. Such brakes! Certainly I have never encountered their like on a heavy aircraft: we turned off quite slowly at the intersection, with nearly half the runway still available. Admittedly there was a fairish wind, but the retardation had to be felt to be believed.

Such, then, were the impressions created by a flight in Bomber Command's forthcoming jet trainer. The B.2 already in service is clearly a very similar aircraft, and it is instructive to draw a few comparisons between it and a typical tactical bomber of the last war—the North American Aircraft Company's B-25 or Mitchell.

Round the normal circuit, the two are curiously similar to fly in many respects. Unstick, approach, landing and single-engined safety speeds are all very similar. Taxying, braking and ease of handling in a cross-wind are a joy in either case. The B-25 had a first-class reserve of power for single-engined flying, but performance in this direction was, of course, not comparable with that of the Canberra, which, as is well known, flies quite remarkably on one engine. On the other hand, the wartime aircraft had the ability to operate out of much smaller fields in emergency: with 30 deg flap and 44in of boost you could get off the ground and up to 300 or 400ft in a remarkably short distance—something like 1,000 yd under light load and with a 10-kt wind, as far as one can recall. Similarly, a really expertly conducted precautionary landing could be carried out at a much lower speed than the normal one. In these respects, then, the Mitchell had the advantage. Over cockpit procedure, on the other hand, the Canberra pilot now gains: the American cockpit was beautifully laid out but contained, inevitably, far more knobs, dials and gadgets than that of a jet aircraft. A comprehensive check list was a very desirable item in those days, whereas it would appear to be unnecessary with a twin-jet military aircraft.

When it comes to analyzing performance away from the circuit, we come inevitably into contact with security, so full comparison cannot be made. Clearly, however, the figures for the Canberra are of the order of twice those for the Mitchell, and herein lies the great difference between the wartime and the present generation of aircraft. Ceilings, speeds, and rate of climb and descent have caused complete revolution in Bomber Command thinking, and have directly necessitated such new items of equipment as pressure cabins, cooling systems, ejector seats and Machmeters, for which there was no demand on the older aircraft. Even the bomb-load of the Canberra appears to be considerably greater than that of its



". . . it is instructive to draw a few comparisons between the B.2 and a typical bomber of the last war—the North American B-25 or Mitchell."

The Canberra . . .

predecessor, judging by the size of the bomb-bay; and if current American fighters can carry tactical atomic weapons, clearly so can a jet bomber. So, for that matter, could a Mitchell.

All in all, therefore, great progress has been made in the years between the introduction of the two aircraft, and we now have a machine with nearly double the performance of the old which is none the less little more difficult to operate out of an adequate airfield, and which has superb power-plant reliability coupled with remarkable single-engined performance if one motor should for any reason be "lost." Everything cannot be gain, however, and against that we must offset the inability of all jet aircraft to hang-about low-down in bad weather, and the difficulty of applied instrument-flying under modern conditions. In this respect the Canberra pilot needs to reach and maintain a higher degree of skill than did his elder brother ten years ago.

D.I.C.

Production Testing

THE Canberra is well-known for its versatility in combining high speed over great distances with manœuvrability at high and low altitudes, in which respect it has been found more than a match for most fighter aircraft.

These qualities are universally appreciated, but behind them—and far less publicized—is the fact that Canberras have been flowing out in large numbers from the factories to the Royal Air Force during the past two years. This flow has necessitated further development of the existing organization for preparation, ground-testing, flight-testing and despatch, because, although the largest part of the flight development of an aeroplane is completed in the extensive development testing of the first prototypes, it is always possible for defects to develop during assembly, or in ancillary equipment. Each production aircraft, therefore, needs careful testing over the whole of its performance range, followed by the correction of faults, before it is acceptable to the Ministry of Supply for delivery.

It is not many years since even military aircraft were of sufficient simplicity as to necessitate their being flown only once—or possibly twice—after rolling off the production line and before being deemed in a fit state for delivery; but the range of speeds and altitudes to which the modern jet aircraft must be proved calls for considerably more flying, and can naturally result in more minor defects which must be corrected and then re-checked in flight.

In the case of the Canberra, it became apparent at an early stage that special provisions would need to be made to enable the test pilot to continue with flight-testing in adverse weather conditions. Even as late as the last war, heavy bombers could be cleared after one or two short test flights round the airfield and below the cloud-base; but today a jet bomber must be tested to at least 45,000ft and dived to very high speeds.

These conditions require either excellent flying weather, with little cloud and good visibility, or else some alternative aids to the pilot. For this reason Marconi AD.200 long-range V.H.F. direction-finding radio was installed at one of the English Electric Company's airfields, and, with its use, the test pilots have been able to continue production testing in weather which would otherwise have grounded them.

In addition to the use of radio aids, a further change in test-flying practice has been needed in connection with weather restrictions, for although radio-homing enables the test pilot to take off, climb through cloud and carry out tests above cloud, with the sure knowledge that he can be brought back to base by radio bearings when he requires them, radio control does not help him in testing where poor visibility is concerned. This can best be explained in the following terms.

One of the most important phases of testing the Canberra—that of performance measurement—calls for flying level at full power at various points in the altitude range of the aircraft for long enough periods to stabilize the absolute maximum speeds. It naturally takes some minutes of flying at full throttle for an aircraft to settle down to its maximum speed at any given altitude and weight, and at the speeds of present-day jet aircraft very considerable distances are covered during these tests. For example, at the low end of the altitude range the maximum speed of a Canberra on production test has to be measured at 2,000ft. This condition is reached approximately four minutes after the beginning of the run, but during that time a distance of approximately 40 miles will have been covered.

These and other trials at low and medium altitude are essential parts of the production test-schedule; so when, as frequently happens, weather conditions are only suitable for radio-controlled flying at high altitude and, owing to mist, low cloud or smoke haze, quite unsuitable for these high speeds at the low altitudes, it has become necessary to develop the practice of using the speed-over-distance properties of the Canberra to fly in search of weather suitable for test purposes.

This technique is quite at variance with established test-flying principles and tradition, as it has hitherto always been regarded as essential to remain within a 25-mile radius of the base aerodrome while carrying out test flights. With the Canberra, when weather conditions are unsuitable for specific tests in the Lancashire area, it is now the normal practice for the pilot to obtain weather information from various sources such as the local Airways Control Centre, other test pilots, or visiting pilots who have just landed; then he may set off for such areas as the East Coast from Newcastle to the Wash, the South Coast in the Isle of Wight-Portland area, or the North-West Coast from the Isle of Man to Glasgow—whichever seems to be most suitable.

All these areas can be reached within half an hour by Canberra from Preston, and the necessary tests are then carried out wherever suitable weather is found. The return flight to base is then made possible with safety in otherwise adverse weather conditions by the Marconi radio homing equipment which can, and frequently does, steer the aircraft back to the Preston area from more than 200 miles away.

This type of operation, which might well be described as long-range test-flying, could not be carried out without increased risk to the aircraft if there were not adequate facilities for diversions or emergency landings near the areas selected for testing over.

This aspect is covered by the radio-control networks and airfields of the British aircraft industry, in the London and South Coast regions; by the radio and airfield facilities of Bomber and Fighter Command on the East Coast; and by those of Maintenance and Coastal Command in the North-West. Thus, at no time during these flights, which frequently cover more than 1,000 miles in two hours, are the Canberras out of range of adequate emergency radio and landing facilities.

At first glance this may appear to be an undesirably complicated procedure, but in practice it has proved essential to the maintaining of a steady flow of these jet bombers from the production line through the flight-testing and acceptance stage to delivery to the Royal Air Force; and it is significant that the unusually inclement weather of the winter of 1952–3 has not resulted in any major interruptions of Canberra delivery.

Apart from this weather question, and the measures taken to overcome it, there have been no unusual features in the general testing of production Canberras, as the type is a simple, straightforward and even docile aeroplane, lacking complication in its flying characteristics; the only factors which render its flight-testing in any way unusual are those of its performance. After some years of continuous work on it, test pilots still find it a strange experience to be flying well above 40,000ft, 200 to 300 miles from their base airfield, so soon after take-off.

Re-equipping the R.A.F.

On the Service side, it might be expected that Bomber Command would have re-equipped with Canberras at a rate roughly similar to the manufacturers' production rate, but initially this has not been so, for the following reasons. When the first prototype flew in 1949 there were no jet aircraft, in this country or elsewhere in the world, which were capable of flying continuously at altitudes greatly in excess of 40,000ft for many hours at a time. Until then, all practical experience of flying at these heights had been limited to short-duration flights with jet- and piston-engined aircraft at their absolute ceiling limits. By the end of 1949 there were many experimental and research establishments of the Air Ministry, the Ministry of Supply, and also of the aircraft industry, which were seriously hampered in their attempts to keep pace with the development of equipment for high-altitude flight by the lack of suitable aircraft in which to test it.

So it came about that, as soon as the Canberra had proved its capabilities, the Ministry of Supply had very pressing reasons for diverting early Canberras to these establishments for high-altitude flight research. Because of this, by the time Bomber Command had received their first three squadrons of Camberras, a similar number of these jet bombers was already being employed on vital research work, in connection with the present generation of high-altitude, high performance military aircraft.

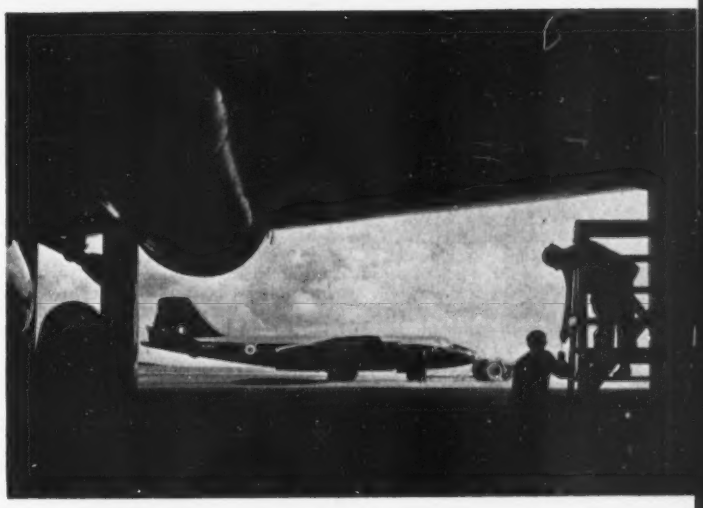
Now, however, Canberra B.2s have been flowing to the Royal Air Force at a steady rate for many months. In this initial year of Service experience, much useful information has been accumulated in the operation of their new jet bomber and, wherever possible, this information leads to modifications to the production line so that the aircraft continues to be improved to meet the Services' changing requirements.

During this re-equipment, Bomber Command had to face one of the biggest changes of maintenance, training, and operational philosophy in Service history, when, at a stroke, the piston-

engined Lincoln bombers gave way to the hundreds-of-miles-an-hour-faster Canberra. This tremendous change was tackled with the resource and enthusiasm which is a Royal Air Force tradition, and within a short time the Canberra had settled down to a normal Service operational existence, as remarkable for its high serviceability and its tremendous popularity with the pilots as for the great increase in performance which it brought to the Command.

The Canberra bombers continue to flow from the line, with the test pilots flying many sorties a day to areas as far apart as Dover and Belfast for their flight testing, and new marks are beginning to roll off the line to add another punch to the strong arm of Bomber Command.

Behind this scene lie the continuous research and development and experimental flight-testing which ensure that the current production aeroplane keeps pace with Service requirements, and which prepare the way for even more useful marks of this versatile aircraft destined to enter the Royal Air Force in the near future.



Emergence for test-flying: a pleasant impression at Samlesbury.

PARTY AT RINGWAY

TWO test pilots at the northern factories of the Fairey Aviation Co., Ltd., David Masters and Ken Forbes, were hosts at a cocktail party held at Ringway Airport on May 21st.

Guests included officials of Manchester Corporation and Ringway Airport, where Fairey's northern flight test unit is based; Avro's Chief Test Pilot, Jimmy Orrell, from nearby Woodford; J. S. Fyfield, test pilot at De Havilland, Chester, for whom Faireys are assembling Vampires; the C.O. and other senior officers from R.N.A.S. Stretton and R.A.F. Ringway; and local representatives of M.C.A., B.E.A. and Shell.

FOR ACCURATE AIR SURVEYS

AIR-SURVEY work, and air mapping in particular, call for a high order of dimensional stability in the photographic negative-base employed. In this respect glass plates are almost ideal since, except for the normal expansion or contraction with variation of temperature, they are not subject to dimensional changes from other causes. Films, however, usually show some degree of instability due to the behaviour of the cellulose esters forming the flexible base. They swell slightly during processing in the darkroom and shrink on drying. This effect is further complicated by differing in magnitude on the length in relation to the width. A further shrinkage occurs with long storage.

Dimensionally stable film-base has been available for some time past, but the greater proportion of it has had to be imported from the United States, at a cost of precious dollars. It is, therefore, gratifying to learn that Ilford, Ltd., in conjunction with BX Plastics, Ltd., have now produced an all-British base of this type.

Ilford S.R., as the new material is called, is claimed to be one of the most stable plastic bases of the cellulose type commercially available. The process by which it is made leaves a minimum amount of residual strain in the plastic base, ensuring that the differential dimensional changes which do occur are of a very low order.

There is at present no universally accepted British standard or specification for shrinkage-resisting film base, but it is stated that Ilford S.R. base can meet the requirements of the United States Army-Navy specification AN-F-40 for topographic film.

TEST PILOT'S NEW POST

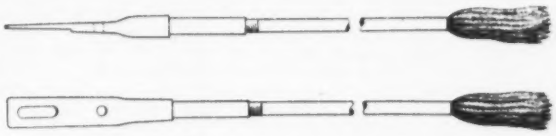
Mr. Michael Daunt, O.B.E., at one time Gloster's chief test pilot—he made the initial flights of the prototype Meteor—has recently joined the technical sales side of Export Packing Service, Ltd., of Sittingbourne, Kent. He thus brings his experience of flying high-speed aircraft to bear upon the also-specialized problems of packing them and shipping them to all parts of the world, for this is a leading side of the company's activities.

DISPERSING STATIC ELECTRICITY

DETAILS are now available of the equipment manufactured by Chelton (Electrostatics), Ltd., of Marlow, Bucks, for the prevention of static interference with aircraft radio equipment. The items concerned are the "Driwik" silent static discharger and the Chelton insulated aerial system.

As is well known, aircraft in motion frequently pick up large electrical charges, by passing through regions of differing potential, or from precipitation, or from friction caused by dust or ice particles. The charge is subsequently lost from the surface of the aircraft in a series of uncontrolled bursts, which produce the well-known interference from which all radio and radar devices suffer.

Dischargers provide a path down which steady, controlled and therefore "silent" discharge can take place at a lower potential than that required to cause discharge from the airframe itself. In the "Driwik" discharger the actual point of discharge into the air



A typical "Driwik" discharger in elevation and plan.

is some 12 inches behind the point of attachment, so that conduction between this point and the aerials is purely through the air and not *via* the metal of the aircraft, which is a much better transmitter of any radio oscillation set up by the improved discharge. "Driwik" units are made up of stranded cotton wick, impregnated with metallic silver and encased in plastic; life is claimed to be at least 1,000 hours.

To get full benefit from the "Driwik" system, the aerial itself must be insulated, and Chelton's have standardized seven-strand 28 s.w.g. stainless-steel wire covered with black polythene for all aerials; they have also designed an ingenious unit system of chucks and other components from which almost any desired aerial can be built up.

NIGHT-FLYING INVENTION CLAIM

BEFORE the Royal Commission on Awards to Inventors, a claim was lodged on May 18th for an invention which, it was contended, had brought about an important change in wartime night-flying instruction. Making the claim were Mr. C. H. Wood, and his brother, Mr. A. W. Wood.

Mr. J. P. Graham, Q.C., for the brothers, said that during 1940 the problem of night-flying instruction had become a bottleneck in the expansion of the R.A.F., and particularly Bomber Command. At that time Mr. A. W. Wood was a Link Trainer instructor, and he put the problem of the simulation of night conditions during day time to his brother, a photographer. As a result they developed filters which could be attached to goggles and cockpit windscreens and which cut out all natural daylight but allowed sodium flarepath lights to penetrate.

Mr. Graham said that the filter scheme had been adopted and was still being used in many countries for both Service and civilian pilot-instruction. No decision has yet been announced.

THE INDUSTRY

Power Jets Appointment

IT is announced that Mr. T. G. Hicks, M.A., C.P.A., has been appointed joint managing director of Power Jets (Research and Development), Ltd.

Mr. Hicks was educated at Bradfield College and at Trinity College, Cambridge (where he read Natural Sciences), qualified as a patent agent in 1933, and was engaged in private practice until the war. He then served in the Technical Branch of the R.A.F.V.R. and in 1946 joined the Patents Branch of the Ministry of Supply, being detached to work at the Royal Aircraft Establishment, Farnborough. He joined Power Jets in May 1950.

Rumbolds Celebrate

CORONATION celebrations by L. A. Rumbold and Co. Ltd., took place recently at the Cumberland Hotel, London, when Mr. and Mrs. Rumbold welcomed 121 guests drawn from the aircraft industry, airlines, charter companies, the Royal Aero Club and senior members of the firm's own staff.

Stress was laid on the business in hand—enjoyment of the evening to the full—and speeches were short almost to the point of extinction. R. S. Stafford, chief designer to Handley Page, Ltd., did note in passing that for his firm alone, Rumbolds had been responsible for the interior furnishing of 1,590 Halifaxes, 150 Hastings and 29 Hermes.

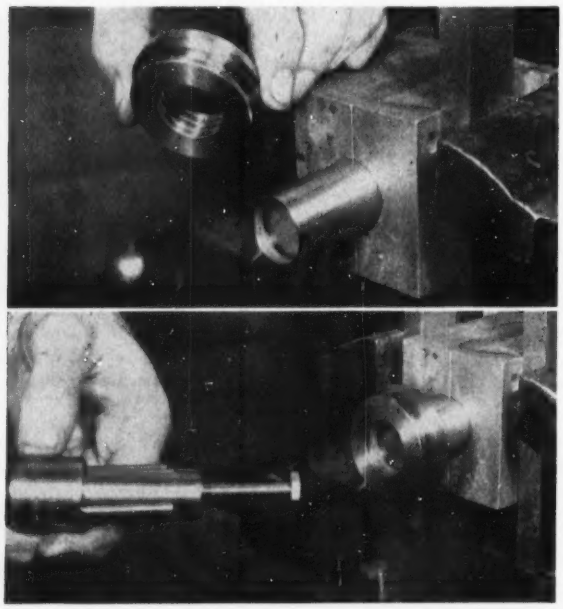
Means to an End

END-FITTINGS designed for attachment to rigid tubing by mechanical means with suitable hand tools, and without the need for brazing, welding or flaring operations, are a recent development by Avica Equipment, Ltd., 1 Adams Place, Georges Road, London, N.7. Coupling parts can be made in non-stabilized stainless steel, cadmium-plated mild steel, anodised aluminium, or titanium.

It is claimed that extremes of temperature and vibration have no effect upon this design of leak-proof fitting, while any fluids, gases and corrosive agents can be handled provided the appropriate material is selected for both tube and fittings. Aluminium fittings can be attached to aluminium tubing by this method without the application of heat or excessive working of the tube; for example, light-alloy fittings may be attached to light-alloy tubing, or, for higher pressures, Tungum fittings to Tungum tubing. Similarly, stainless-steel tubing can be expanded into Avica stainless-steel fittings, thereby eliminating any changes in the characteristics of the metal, or tendencies to corrosion or weld-decay, as might occur in welding or brazing operations.

Briefly, the process of attachment is as follows: the tube is gripped in the correct size of Avica tube-holding block, in a vice, and the end trimmed square and cleanly finished inside and out; the appropriate size of end-fitting ferrule (together with a swivel flange, if required) is then slid over the tube until the latter butts against a stop flange within the ferrule; and an expander tool—a taper mandrel provided with rollers in its working face—is then inserted in the tube-end. Turning the mandrel in a clockwise direction has the effect of expanding and swaging the tube into three annular grooves in the bore of the ferrule.

The fittings can be salvaged for re-use by removing the tubing from the fitting by a suitable method—e.g., turning in a lathe.



An Avica end-fitting (top picture), showing the internal grooves and (below) the expander-mandrel about to be inserted ("Means to an End", above).

IN BRIEF

From June 22nd to 26th a residential short course on management accounting will be held at the College of Aeronautics, Cranfield.

* * *

C. C. Wakefield and Co., Ltd., announce that their managing director, Mr. Alonzo Limb, has also been elected deputy chairman. The chairman is Mr. L. W. Farrow, C.B.E.

* * *

G/C. Morice, D.S.O., M.C., sales manager of Dunlop's Aviation Division, has moved his headquarters from Dunlop House, Albany Street, to 10-12 King Street, St. James's, London, S.W.1.

* * *

As from June 30th, the plastics division of F. G. Miles, Ltd., will be transferred from Redhill to Shoreham Airport, Sussex.

MR. JOHN S. BIRD, appointed sales liaison executive to Kent Alloys, Ltd., Rochester, who do a considerable volume of casting, machining and assembly work for the aircraft industry. He has held posts with Vickers-Armstrongs and Rolls-Royce, and has been a test pilot and served in aircraft carriers during the war.

In our issue of May 22nd we published a note on G/C. E. L. Mole's new venture as an aviation consultant. It should be added that his office address is 31 Dover Street, London, W.1 (Grosvenor 5902).

* * *

Shortly leaving for South Africa is Mr. A. Cody, sales manager of Conveyancer Fork Trucks, Ltd., Warrington; he is to make a year's business tour of various areas in Africa.

* * *

Sheepbridge Engineering, Ltd., announce the appointment of Mr. R. E. Dawtrey as chief engineer. He will be responsible for all metallurgical, chemical and engineering research and development by the company.

* * *

In a recent reference to flexible piping it should have been made clear that Bowden (Engineers), Ltd., are large-scale manufacturers not of hose but of high-pressure flexible hose units, i.e. of complete assemblies embodying high-pressure reinforced hose.

* * *

The Hymatic Engineering Co., Ltd., have appointed as agents Henry Waugh and Co., Ltd. (Palmerston House, 51, Bishopsgate, London, E.C.2), who will stock Hymatic air-compressor and other equipment at their branches in Singapore, Malaya, Thailand, Sarawak, Labuan, Brunei and British North Borneo.

* * *

Mr. J. W. W. Dyer, M.Sc., A.R.I.C., who has recently retired from his position as a principal scientific officer at the M.o.S. Research and Development Establishment, Cardington, has now joined the R.F.D. Co., Ltd., of Godalming, Surrey. Mr. Dyer is a leading authority on the development of rubber-proofed textiles for aeronautical uses.

* * *

Pressure control equipment—valves, distributors, reducers, controllers, etc.—are described and illustrated in lists from I.V. Pressure Controls, Ltd., Forge Works, 844 Bath Road, Cranford, Middlesex. A number of valves are designed for manual and/or solenoid operation, and for fluid pressures of up to 4,000 lb/sq in; hydraulic valves to handle up to 8,000 lb/sq in are also listed.

PROGRESS

Already the Avon engine has progressed from the basic RA.2, with its initial thrust of 6,000 lb., through the RA.3 to the 7,500 lb. thrust RA.7 with full anti-icing and the RA.7R, re-heat, of 9,500 lb. thrust.

Avon engines have already flown over 40,000 hours.

ROLLS-ROYCE
Aero
ENGINES

ROLLS-ROYCE LIMITED, DERBY

The aeroplane

The Hawker Hunter. Generally accepted to be the best fighter in the world, this super-sonic aircraft is expected to be in general service with the R.A.F. later this year. Span : 33′ 3″. Length : 45′ 3″. Powered either by a Rolls Royce Avon or Armstrong Siddeley Sapphire

the pilot

At 31 years of age, Neville Duke, Chief Test Pilot at Hawkers, is the holder of an impressive and distinguished record, and was recently awarded the O.B.E. During the war he won the D.S.O., D.F.C. and 2 Bars, A.F.C. and Czech. Military Cross. He was credited with 28 confirmed victories. Since then he has contributed his services to the Empire Test Pilots School, High Speed Flight, and The Ministry of Supply's Establishment at Boscombe Down. He has served as C.O. of 615 Squadron, Biggin Hill. Of the Shell and BP Aviation Service he has this to say :— "I have always been provided with prompt and efficient service by Shell and BP."

Shell and BP Aviation Service

On distant tarmacs the sight of the unmistakable Shell and BP Refuelling trucks is a reassuring sign to pilots. Here, indeed, is a home-away-from-home. Airmen, whether commercial, Forces or private, know the comfort of one less problem on their hands. Aircraft manufacturers rest in the assurance that their fuelling specifications can and will be met. These immense resources are yours for the using any time — and practically anywhere.

SHELL-MEX AND B.P. LTD., Shell-Mex House, Strand, London, W.C.2.
Distributors in the United Kingdom for Shell and Anglo-Iranian Oil Groups.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Historic Aircraft Endangered

IT is most disturbing to hear that the Nash Collection is for sale, and is likely to go to an American bidder. Although we have become used to the mighty greenback getting its own way in most spheres, can we do nothing to stop these fine examples of the skill and ingenuity of the men who started Britain off on the right foot in the flying world being shipped away to an American museum?

A Bill has just been passed in the House authorizing the expenditure of half a million pounds for the purchase of fine and ancient buildings, while a further £250,000 is to be spent annually on their maintenance; a very creditable piece of legislation which will appear as little more than a comma among the astronomical figures involved in the national budget. But for how much less could the frail examples of early achievement be bought and maintained for the benefit of future generations who will accept air transport as something too commonplace to be remarkable?

Cannot the Government, or some other national body, show a little foresight? It wouldn't cost much.

Denham, Bucks. R. E. GILLMAN,
Chairman, Vintage Aeroplane Club.

"Forcible Feeding"

YOUR editorial under the above heading (May 15th) gave stress to what has long been my flying training axiom No. 1, i.e. "Flying experience is gained not simply by flying hours, but by those hours spread over a period of time" (para. 4, "Aircrew Training," *Flight*, February 13th, 1953). In other words, a pupil must have plenty of time to think, talk, read, argue and discuss flying—time to re-live every minute of every trip, and, by so doing, increasingly develop that indefinable quality which, for want of a better word, we term "air-sense."

My second axiom is, "A pilot should be 25 years of age, with at least five years training, before going on to 'productive' flying." After all, who would think of sending a 20-year-old half-way across the world as captain of a quarter-million-pound oil tanker after only twelve months of intensive training? Why, then, expect him safely to captain an aircraft of almost the same value, in an environment containing greater hazards?

How are we to afford to give this training, spread over a period of time? Once again, I reiterate that it can be done by a five-year part-time "flying apprenticeship" scheme. University air squadrons are the nearest approach to this type of scheme at present, but only a minute percentage of their personnel pass on to productive Service or civilian flying.

Could not a scheme be adopted to embrace a wider section of the eligible population and give opportunity to those more likely to make flying their career? Perhaps also this scheme could very well be the answer to "Whose Problem?", page 609, *Flight*, May 15th, 1953. B. V. GEMMELL,

Woodvale, Cheshire. for Chief Instructor, No. 19 R.F.S.

Combat Psychology

IN a recent article (May 15th) you summarized an important paper on the psychological aspects of combat flying. The author mentioned that the omnipotent cause of neurosis caused by flying was fear. He went on to say that no reliable method of selection had yet been found.

I should like to point out that I, for one, tried very hard during the war to point out that one very large and very cardinal error was being made almost all the time in the selection of pilots for combat. The paper mentioned the rejection of all those grossly unsuitable at intake. So far as I could make out, this included all the young men who had gone to the trouble and expense of learning to fly before the war started. Yet, in my opinion, the only real antidote to fear is interest. The only people really competent to say that a man should not undergo the stress of operational or combat flying is someone who doesn't mind trying it, who has done so, and who still thinks the thrill is worth the worry. I would suggest that there were very few medical officers who had this experience.

Many pilots maintained their status as combat flyers as a matter of duty, with good breeding, sound education, perhaps many years of secure parental example, and a fairly robust outlook of life; this bolstering-up was possible, but only for a time. I spent a great deal of the time with pilots in the air, as a pupil myself, as co-pilot on various escapades, and as instructor. Some looked back to the good old peaceful days, many looked forward to an early catastrophe, but some quite frankly were enjoying themselves. The last category never got neurosis, or, if they did, they were capable of keeping it in its place and, like Scarlett O'Hara in *Gone With the Wind*, were able to say, "I'll worry about it tomorrow."

Since the war, I have come across quite a number of pilots who volunteered for combat flying from the ranks. After going through the selection sausage-machine they found themselves not flying, not even in the Service at all. Yet the moment the war is over they are at it again, learning to fly; and, so far as I have been able to judge from teaching them aerobatics and suchlike, they make a very good job of it. This is the real selection. The man who has a spontaneous interest in flying starts with a substantial advantage in combat over the opponent who has not. In wartime, the selectors should be able to choose from people who already fly because they like it. There should be thousands of them, and, above all, the professional pilots should realize that their status would be higher, not lower, if there were very many more private licence holders.

London, W.C.1. J. NOEL JACKSON.

An Identity Established

YOUR correspondent Mr. Gaylard (May 8th) asks for the name of the pilot in his picture of the B.A.T. Crow. It is undoubtedly Captain Vaughan. He had a very narrow escape on this little machine when the bucket seat came adrift from its moorings on the skid and put him out of reach of the rudder bar. He had to haul himself forward with one hand and manipulate the stick with the other. He got down safely into Hendon.

A history of the B.A.T. firm (to which I was apprenticed at its beginning and of which I was the last paid employee) would surely be of great interest today.

For the record, the other test pilots of B.A.T. were Peter Leigh, who was killed while going for the height record in a Basilisk; Major Christopher Draper (still flying, apparently); Robin Duke, later killed as an airline pilot over Beauvais; and "Calf's head" Turner.

London, W.C.1. G. H. SAXON MILLS.

YOUR correspondent Mr. A. H. Curtis (May 22nd) is incorrect when he states that the photograph of the B.A.T. Crow depicts R. Vaughan Fowler in the pilot's seat. It was, in point of fact, a Mr. Vaughan, who was one of the B.A.T. Company's pilots.

London, N.W.4. R. E. NICOLL.

I IDENTIFY the pilot of the F.K.28 Crow as Mr. C. R. Vaughan, holder of Air Ministry pilot's licence No. 57. His face is quite unmistakable (which is not meant to be uncomplimentary). He was an ex-R.N.A.S. pilot of the 1914-18 war with the rank of captain; and did quite a lot of flying for Mr. Koolhoven after the war. The last time I saw him was around 1930, when I was employed by Capt. F. Warren-Merrian, the aeronautical consultant. Capt. Vaughan was one of the many hundreds of pilots who were taught to fly by Capt. Merrian during World War I.

I learnt quite a bit about B.A.T. history from Capt. Vaughan, who flew the Bantam, Basilisk, Crow and, later, the Koolhoven F.K.41 built in Holland, a high-wing monoplane with a Bristol Jupiter. The Bantam was rather tricky, due to the small gap between the wings and lack of stagger; it was deadly when spun.

Cockfosters, Herts. NORMAN V. BRITTAIN.

FORTHCOMING EVENTS

June 5-7. Yorkshire Aeroplane Club: International Rally.
June 6. Leicestershire Aero Club: Coronation Air Display, Leicester East Airfield.
June 7. Aero-Club d'Italia: Rome Grand Prix.
June 8-18. British Plastics Exhibition and Convention, Olympia, London.
June 11. R.Ae.S.: Ninth British Commonwealth and Empire Lecture. "Problems in Development of Air Transport in West Africa." by Sir Hubert Walker, C.B.E.
June 13. "At Home," R.N. Air Station, Lee-on-Solent.
June 13-14. Aero-Club d'Italia: Air Tour of Sicily.
June 13-14. Rhodes Centenary Air Display and Rally, Salisbury, Rhodesia.
June 14. Aéro-Club de Tangier: Tangiers Rally.
June 14. R.Ae.S.: Garden Party, Hatfield.
June 15. Coronation Naval Review.
June 16. I.C.A.O.: Opening of Seventh Assembly, Brighton.
June 17. Aircraft Recognition Society: Special General Meeting.
June 19. Institute of Navigation: "Accuracy of Wind Forecasts for Aviation," by C. S. Durst and D. G. Harley.
June 19-28. Zurich: British Chamber of Commerce "Made in England" Exhibition (including aviation).
June 20. "At Home": R.N. Air Station, Culdrose.

CIVIL AVIATION

I.C.A.O. AID for INDONESIA

LARGEST of the I.C.A.O. missions which, by giving on-the-spot technical assistance, are laying the foundations of civil aviation in undeveloped states, is that situated in Indonesia. With headquarters in Djakarta, the mission has a staff of 27, including advisers, instructors and administrative staff, headed by G/C. E. L. T. Barton, O.B.E. Mr. R. W. Usher is the only other English member of the mission, which includes representatives of America, Australia, Canada, Denmark, India, New Zealand and Switzerland.

The purpose of I.C.A.O. technical assistance in such countries as Indonesia is to promote social and economic progress by facilitating the orderly growth of civil aviation. The United Nations Organization (which also sponsors assistance in agriculture, industry, health, education and other fields) provides the necessary funds—$1.5m for the current year. The aviation budget is, of course, only a small fraction of the total allocated by U.N.O. to development of backward states. Nevertheless, it has been observed that "Governments have assigned a high priority to civil aviation because of the extraordinary contribution which it can make in opening up under-developed countries and in giving them access to world trade."

This is particularly true of Indonesia, where the bulk of U.N. financial assistance is, in fact, devoted to civil aviation. That this aid is appreciated is shown by the fact that the country has itself allocated a good proportion of the national income to the needs of the Directorate of Civil Aviation. On the recommendation of the I.C.A.O. mission, an aviation academy is to be established, and the buildings are under construction.

Ab initio pilot training is being paid for by the Indonesian Government, although the mission provides ground instructors. The number of student pilots under instruction—which extends to commercial pilot's licence standard—is 54, of whom 30 are being trained (initially on Chipmunks and Aiglets) at the Indonesian Flying School near Tangerang. The remainder are with Air Service Training, Ltd., at Hamble. For the next two years the output of pilots will be 30 per annum; this will drop to 15 and, finally, to a rate sufficient to cope with annual wastage. Incidentally, the recent formation of two national flying clubs—at Bandung and Djakarta—should ensure a supply of suitable recruits. A remarkable feature of these clubs is that the aircraft (Piper Cubs) and instructors are provided by the Indonesian Air Force at the exceptionally low rate of some 16s per hour.

One of the most important of the mission's duties is to advise the local authorities on the improvement of airfields and of navigation facilities. Over 30 designated airfields, many of them grass strips, but capable of handling Dakotas and Herons, have been toured by I.C.A.O. experts, who have submitted development plans to the administration. Including pilots, the number of Indonesian students under training is well over 100, courses being held for air traffic controllers, radio operators, aerodrome managers and radio, airframe and engine mechanics. The staff of the mission includes instructors on all these subjects, together with advisors on communications, economics, radio maintenance, airports and personnel licensing. The mission is also responsible for selecting 12 Indonesian students for "fellowship" training abroad.

To tabulate the number of students trained and I.C.A.O. fellowships awarded in undeveloped countries gives a very incomplete impression of the value of the technical assistance programme. The secretary general of I.C.A.O. pointed out last year that : "The presence of experts in various branches of aviation has resulted in a wide variety of improvements in detail. . . . Communication centres have been reorganized to effect better reception and transmission, approach and let-down procedures at airports have been devised and pilots and controllers taught to apply them, departmental reorganizations have been effected for improved efficiency, civil aviation authorities have sought advice on their duties and responsibilities, counsel on the cost of administering airports has been given for the preparation of government budgets, safety measures of infinite variety have been taught to those responsible. A complete catalogue would include the whole range of knowledge and experience which the experts bring with them to their assignment from their careers in advanced countries . . ."

TRAINING IN INDONESIA: Senior executives concerned with the training of Indonesian civil-aviation personnel are shown (top) with one of the Aiglets used to train future commercial pilots from the ab initio *stage: (left to right): Mr. A. Warren (Canadian flight instructor), G/C. Barton (head of mission), Mr. Germania (Indonesian head of the aviation college), Mr. G. A. Crowley (American chief of technical training), and Mr. M. F. Vandiver (American chief training adviser). In the centre view, Mr. M. Cuxson (Australia) is seen with a class of radio mechanics; below, Mr. H. B. Bridges (U.S.A.) is supervising the communicator typing class, which includes two girls.*

Liquid propellent starter

- Operates from 24 volt, 25 A.H. battery.
- System independent of external aid.
- The push of a button initiates automatic starting cycle.
- Idling speed reached in approximately 12 seconds.
- Torque limiting feature provides for re-engagement into running engine.
- Only 15 seconds delay between starts.
- Number of starts dependent on size of fuel tank.
- Automatic and positive overspeed and fuel cut-off controls.
- Fuel isolated from starter except when operating.
- Altitude and environment proofed fuel system.
- Starter and equipment corrosion proofed.
- Gear-box oil lubricated from engine.

Full technical information and advice available.

Complete electrical systems for aircraft

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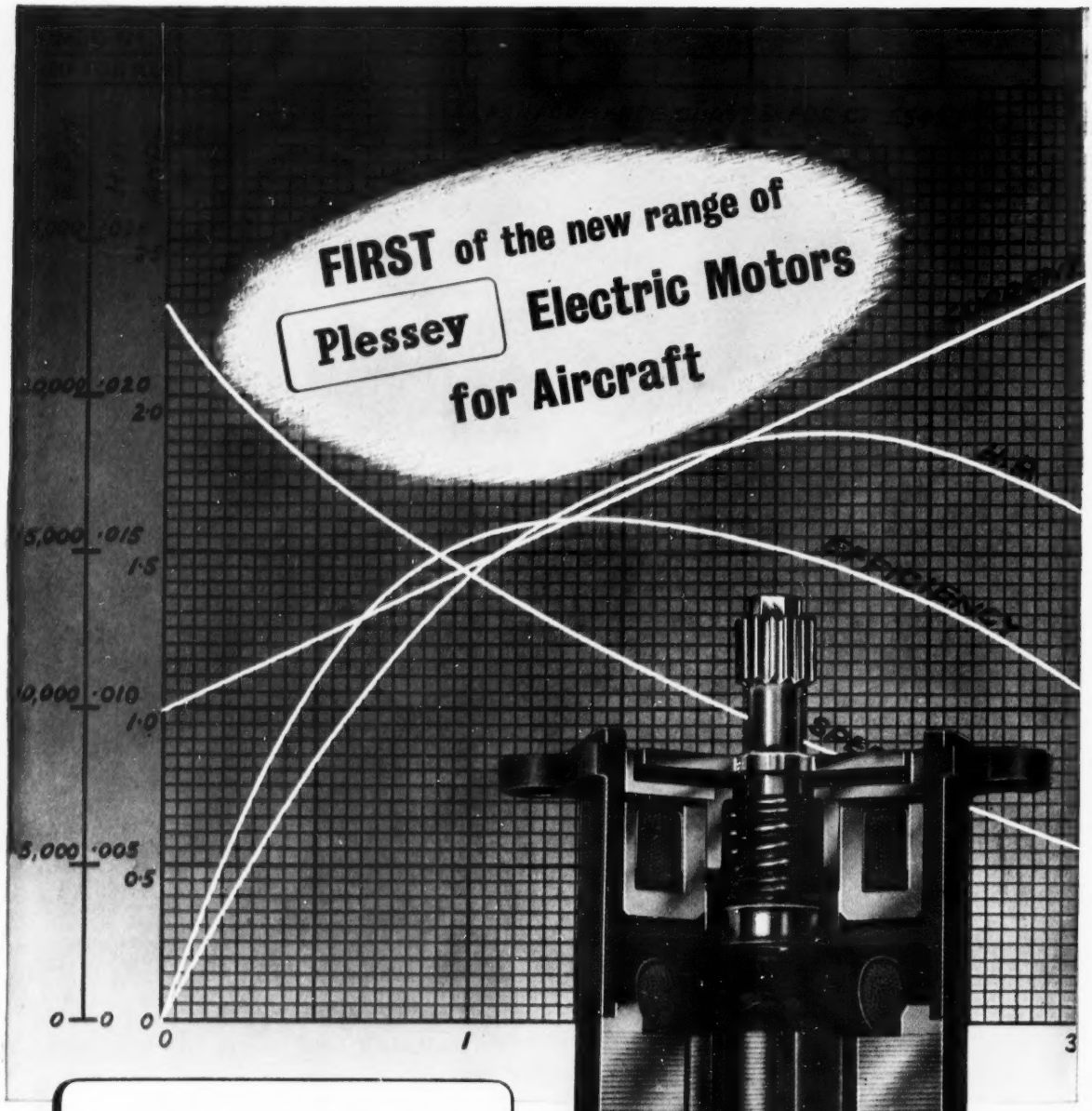


Plessey

AC29

This low-power reversible split series field motor for actuators is the first of the new Plessey standard motors. It is fitted with series brake, and fully tropicalised. Others, soon to be available, will cover a diversity of power applications in aircraft. Where necessary, Plessey will modify a standard design to fulfil any special requirements.

PUMPS · VALVES · CARTRIDGE STARTERS PRE-FORMED WIRING SYSTEMS ELECTRIC ACTUATORS

THE PLESSEY COMPANY LIMITED · ILFORD · ESSEX

THE FIRST DOUGLAS DC-7 made its maiden flight at Santa Monica on May 18th; 12,000 Douglas employees witnessed the event. Powered by 3,250-h.p. Wright compound engines, the DC-7 is 3ft 4in longer than the DC-6B and will carry up to 95 passengers. So far 58 have been ordered by four American operators.

CIVIL AVIATION . . .

C.A.A. RE-EQUIPMENT

PERMISSION has been granted to Central African Airways Corporation by the Central African Air Authority to buy four DC-3s, and the company hopes that, if current negotiations are successfully concluded, delivery will begin immediately. The new machines would be used initially to run services normally operated by Vikings, which are at present grounded pending modifications. When the Vikings are back in service, the Dakotas will be relegated to some of the less busy, though none the less important, C.A.A. routes.

It is also learned that the company has requested the Air Authority for permission to buy three Lockheed 1049G Super Constellations. Cost—which also includes certain improvements scheduled for Salisbury Airport—would be about £3,750,000, and delivery of the aircraft could be expected in 1955.

PAKISTAN'S AIRPORTS

AT the time of partition, Pakistan was left with only one major airport, at Karachi. Now efforts are being made, not only to improve the facilities at Karachi, but to convert existing small fields at Dacca, Ishore and Nawabshah into up-to-date airports. At Karachi, modern night-landing equipment has been installed, and a new comprehensive transmitting station is in process of construction. At Dacca and Ishore, existing runways have been relaid, while Nawabshah has been developed as diversion airport to Karachi. Two Pakistan airlines are in operation at the present time, Orient Airways, Ltd., and Crescent Air Transport, Ltd.

AER LINGUS BIRTHDAY

ON May 26th, Aer Lingus celebrated its 17th anniversary. In its first year of operation it transported but 800 passengers; today, 2,000 are carried daily at peak periods, 90 per cent of the 1½ million passengers concerned having been flown to their destinations during the past six years. Staff has increased from 12 to 1,500 during the 17 years, 97,000 trips have been made, and 326m passenger-miles flown.

CO-OPERATION IN EUROPE

NEW proposals have been made for the conference on the subject of co-ordinating air transport in Europe. The I.C.A.O. Council has agreed to the suggestion made by the Committee of Ministers of the Council of Europe that nine states (Belgium, Denmark, France, Italy, Netherlands, Norway, Sweden, Switzerland and the United Kingdom) should form a preparatory committee to develop an agenda for the forthcoming conference. This committee is to make its report to I.C.A.O. by early autumn, and a date for the conference should then be fixed.

Possible methods of improving the economic efficiency of Europe's regional air transport network have already received a great deal of attention at various levels—international, governmental and industrial. A proposal for unification of European air services was made to the Council of Europe by Count Sforza as long ago as May, 1951, although the results of these studies have not yet been of a very far-reaching nature. A senior I.C.A.O. executive, Mr. Edward Weld, recently expressed the view that "governmental and industrial measures seem to be moving on parallel lines and to be nearing fruition. . ."

THE COMET INQUIRY: B.A.L.P.A. STATEMENT

THE British Air Line Pilots' Association has issued a long statement deprecating certain Press reports of the public inquiry into the recent loss of a Comet in India. Outlining the factors considered by a captain in making his decision whether or not to take off under adverse weather conditions, the statement points out that if he were to take into account the possibility of violent storms in certain places at certain times of the year, "the probability is that 90 per cent of the operations which are now conducted safely there would never be undertaken at all." The Association condemns implications at this stage "that the pilot was responsible for the accident because he failed to heed 'storm warnings' supposed to have been given by a man on the ground."

This case has emphasized a harmful feature of public inquiries into aircraft accidents. Each day of an inquiry brings fresh evidence which is publicized according to sensational value, rather than in relation to its bearing on the accident. Since even an expert cannot form an opinion until he has heard all the evidence, the public are much less likely to see the facts in perspective. In this particular case, several months will elapse before it becomes possible to assess with precision the sequence of events leading to the accident. Provided that the report of an official inquiry can be issued with the minimum of delay, there is a strong case in favour of holding the inquiry itself in private. An incomplete day-to-day story is likely to lead initially to the circulation of distorted and harmful reports.

PRIVATE VISCOUNT?

THE American newspaper-owner, Col. Robert McCormick, is reported to have approached Vickers-Armstrongs with an offer for a Viscount prototype, presumably the Series 700 prototype, for use as a luxurious personal transport. Although probably the most suitable aircraft in the world for Col. McCormick's purpose, the prototype seems unlikely to be sold; the Series 630 prototype is no longer flying, and the makers obviously need an aircraft for development flying. He is now reported to be studying the prospect of ordering a production-type Viscount.

PUBLIC ATTRACTION

SCHIPHOL airport, Amsterdam, recently recorded its five-millionth post-war visitor; the total is of sightseers and other casual callers only and does not include air travellers. The airport was re-opened to the public in 1946, after recovery from severe war-time damage, and in that year the number of visitors exceeded 200,000. The average annual number is some 750,000, with a record total in 1949 of 912,650. The figures are particularly striking when it is realized that the total Netherlands population is only ten million.

MOLL'S FIVE MILLION

THE well-known K.L.M. pilot, Cdre. J. J. Moll, completed 25 years' service with the airline on May 16th. With military service included, his 28-year experience amounts to some five million miles, and 24,000 hours flown. He started flying in 1925 as one of the first pilots in the Netherlands East Indies Air Force, and later, after transferring to K.L.M., was co-pilot of the D.C.2 *Uiver* which won first prize in the handicap section of the 1934 Melbourne Air Race. During the war, he founded the Netherlands 320 Squadron in England, and flew between this country and Canada, Egypt, Moscow and India.

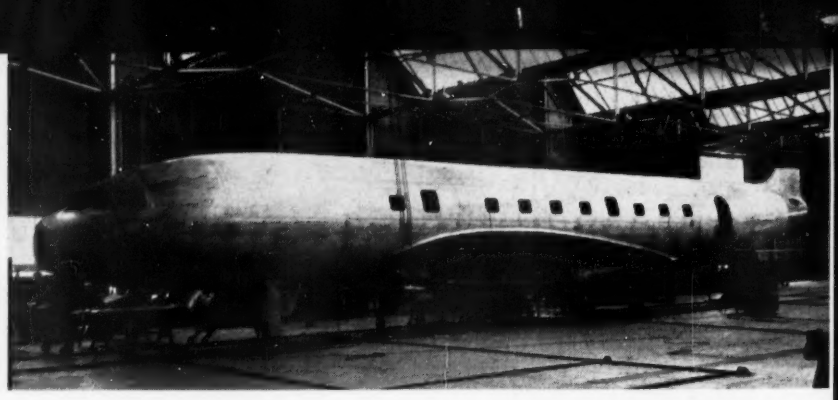
Another "record" was achieved on May 19th, when Capt. Charles E. Blair of PanAm became the first international airline pilot to have made 500 transatlantic crossings. He has flown some 3½ million miles.

HATFIELD ROUND-UP

A LITTLE-KNOWN but very active and useful airline is that operated by the de Havilland Enterprise. The "fleet" consists of Consul G-AHJZ, which operates, with clockwork precision, between Hatfield, Christchurch, Chester and Belfast. (Hatfield, of course, remains the home of D.H. design and development, plus a sizeable production line. The Airspeed division is centred at Christchurch; the comparatively new factory at Chester produces an aircraft every two working hours; and Short Bros. at Belfast are building Comet 2s under licence.)

The Consul service which carries men and materials between these important centres is known to D.H. employees, for no obvious reason, as the "Gold Block Airline." We heard the name for the first time during a recent visit to Hatfield.

First calling-point was the main assembly hangar, where the last of the Series 1A Comets was in the final stages of construction.



TAKING SHAPE: Comet 2 production is well under way at Hatfield, and the first of B.O.A.C.'s fleet of 11 should be flying next month. Shown here is the fuselage of the fourth aircraft (G-AMXE). The Series 2 is readily distinguished from earlier Comets by the extra window forward of the leading-edge, together with the 3ft extension to the fuselage.

CIVIL AVIATION . . .

Protective paper coverings outlined the newly applied French registration F-BGNZ. Outside in the sunshine, its immediate predecessor, NY, was being prepared for engine-running tests. In another part of the hangar NX, the first of the three Series 1As for Air France, having returned from a "shake-down" flight, was undergoing some of the various minor rectifications which must be made before a new aircraft can be offered to a customer.

Of the line of twenty-two Comets ending with F-BGNZ, all but one have been powered with D.H. Ghost centrifugal-flow turbojets. The exception is G-ALYT, development aircraft for the Series 2, which has axial-flow Rolls-Royce Avons. This, and the two original prototypes have been built under Ministry of Supply contract. Other customers were B.O.A.C. (nine Series 1s), C.P.A. (two Series 1As), U.A.T. (three Series 1As), R.C.A.F. (two Series 1As) and Air France (three Series 1As). Each Comet taking shape at Hatfield is known by a works number beginning with 06 (an abbreviation of the type designation D.H.106), followed by a figure indicating its place in the production line; thus, F-BGNZ has the constructor's number 06022.

A smooth change-over from Series 1 to Series 2 production is obviously desirable, and we were therefore especially interested in the degree of progress reached with 06023—the first of B.O.A.C.'s fleet of eleven Comet 2s. Wings and tail were already in position and within a month a fully completed Comet 2, resplendent in B.O.A.C. colours and carrying the letters G-AMXA, should be ready for its maiden flight. Fuselages of the second, third, fourth and fifth machines have already been moved into the assembly hangar and this progress has been backed up in the fuselage shop, where the shell of the ninth Comet 2 has already assumed recognizable shape.

The first of the Comet 2s built at Chester should be completed by July next year and the Short line at Belfast should also turn out its first Series 2 at about the same time. Meanwhile, the Series 3 development aircraft, which is due to fly next year, is taking shape at Hatfield. Some features of this improved version are already being flight-tested, notably the 500-gal "pinion" fuel tanks, projecting nacelle-like ahead of the wings. Mock-up tanks carrying landing lights in the nose have been fitted to the prototype G-ALVG, which also has a modified leading-edge designed to retain good low speed characteristics despite the increase in wing loading which will be an inevitable characteristic of the 145,000 lb Series 3.

The other prototype (G-ALZK) is at present being used for development of the water-injection system incorporated in the Series 1As, but has been tentatively earmarked for a visit to America as soon as this work is completed. The visit has been proposed by P.A.W.A., who, having ordered Comet 3s, are anxious to demonstrate the advantages of jet travel within the United States as soon as possible. No certification problems will arise, since it is not intended to carry any fare-paying passengers. However, the aircraft may operate a series of experimental scheduled services with mail and cargo, as well as carrying large numbers of non-revenue passengers.

CLUB AND GLIDING NEWS

WEATHER for the London Aeroplane Club's dawn patrol on Sunday, May 17th, was poor; nevertheless, a total of 37 visiting aircraft arrived. Of these, five penetrated the Panshanger defences—which consisted of ten patrolling aircraft—to earn their pilots free breakfasts.

Later in the morning, at the Club's annual general meeting, the chairman, W/C. C. A. Pike, reported that during 1952 the Club membership had increased from 210 to 410; flying hours totalled nearly 2,500; 36 members had made their first solos; and 39 Private Pilots' Licences had been obtained.

During the afternoon a forced-landing competition for Tiger Moths was won by Mr. Tim Hilton, and the day was brought to a pleasant close in general appreciation of the club's new premises—with particular reference to the large new bar.

NEW C.F.I. of Lancashire Aero Club, Mr. H. C. Davies, intends to organize a series of film shows concerning navigation, principles of flight, engines, and associated subjects in the near future. The exchange of information on such topics with other clubs would be welcomed.

THE Ulster Flying Club, as reported a fortnight ago, was recently officially opened. The club began flying operations in January last and has two Tiger Moths and a Magister. Nine members are undergoing instruction for private pilots' licences, six already hold licences, and three A.T.C. cadets are training under the flying scholarships scheme. The club's C.F.I. is Mr. George Wynne-Eyton.

DETAILS of the provisional display-flying programme for the National Air Races at Southend-on-Sea on Saturday, June 20th, have been announced by the Royal Aero Club. The Grosvenor Challenge Cup, Norton-Griffiths Challenge Trophy, and Kemsley Challenge Trophy races are to precede an exhibition of aerobatics by the Patrouille d'Etampes, after which will come an individual display by F/O. R. W. Gibson in a Sabre of 410 Squadron, R.C.A.F. Team aerobatics by four Sabres of 441 Squadron, R.C.A.F., will be followed by individual aerobatics by F/L. M. A. D'Arcy in a Meteor of the Central Flying School, and a demonstration by four Canberras of 101 Squadron, Bomber Command. A helicopter demonstration by 705 Squadron, Royal Navy, will precede the final main event, the King's Cup Race.

AT WOLVERHAMPTON after the recent Goodyear Trophy Race: (left to right) A.Cdre J. Oliver; Councillor H. T. Fullwood, Mayor of Wolverhampton; Mr. J. P. Crowther, third prizewinner; Mrs. H. L. Ginaven, wife of the Goodyear director; Mr. Ron Paine, winner; and Mr. G. R. I. ("Sailor") Parker, runner-up. All three prizewinners have entered for most of this season's air races.

A FIRST public appearance by the Slingsby Skylark, a new medium-size sailplane, was made at Lasham over the Whitsun weekend. In the hands of Lorne Welch, Frank Irving, Mrs. Ann Douglas, Hugh Kendall and David Ince (members of the B.C.A. test group) in turn, the machine gave a promising performance—following both ground launches and air tows—including some medium-height aerobatics. The 45ft-span machine has plywood-covered wings, giving a very smooth surface, and the price is expected to be under £700. We hope to print a full description of the Skylark, with three-view drawings, in an early issue.

THE World gliding championships in 1954 are to be held at Camphill, near Great Hucklow, Derbyshire, scene of this year's national competition. The decision that Great Britain should organize the event was made at the recent F.A.I. Gliding Commission meeting in The Hague.

THIS DISC BRAKE HAS

Fully Automatic Adjustment

...SAVES MAINTENANCE TIME AND COST

THE GOODYEAR single disc aircraft brake represents a new advance in safety and convenience.

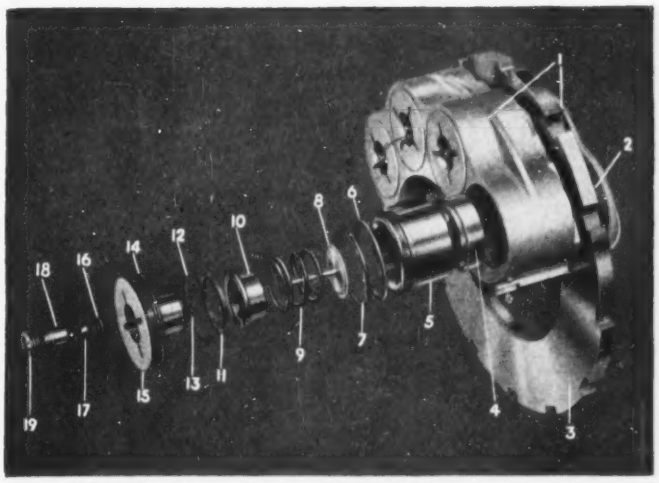
The brake is so designed that the predetermined clearance remains constant throughout the entire life of the linings. Adjustments are therefore unnecessary.

This means that periodic inspection and lining replacement is the only maintenance required.

Specially designed to ensure rapid heat dissipation, and simple in operation, the Goodyear disc brake has won wide acceptance from the aircraft industry.

The Goodyear Aviation Division will help you solve your landing gear problem, too. Technical representatives are always available to give advice, or to join in consultation with your own design staff. They will help you to see the job right through, from the drawing board to installation and servicing.

Clearance remains constant during the entire life of lining



Exploded view of the Goodyear Disc brake, showing arrangement of the automatic adjustment components.

1. *Brake Housing* **2.** *Inboard Lining* **3.** *Disc* **4.** *Outboard Lining* **5.** *Piston* **6.** *Leather Wiper Ring* **7.** *Piston Seal* **8.** *Self-Adjusting Pin* **9.** *Brake Release Spring* **10.** *Spring Seat* **11.** *Spring Retaining and Adjusting Ring* **12.** *Retaining Ring* **13.** *Adjusting Pin Seal* **14.** *Cylinder Head Seal* **15.** *Cylinder Head* **16.** *Washer* **17.** *Adjusting Pin Grip* **18.** *Spacer* **19.** *Adjusting Pin Nut*

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AIRCRAFT TYRES
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BRITAIN'S LEAD IN THE SKIES

First Atlantic Flight by COMET

On Friday, May 29th, 1953

a de Havilland Comet

recently delivered to 412 Squadron

Royal Canadian Air Force

flew from

LONDON TO OTTAWA

3,545 miles in 10 hours 48 minutes
arriving three minutes ahead of schedule

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SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

ROYAL CARRIAGE: Queen Elizabeth, at tail of aircraft, inspecting the Westland Sikorsky S-55 of the Fleet Air Arm used by the Duke of Edinburgh for recent journeys to and from Buckingham Palace. It was piloted by Cdr. H. R. Spedding, Commanding Officer of No. 705 Squadron, F.A.A.

CORONATION HONOURS

HER MAJESTY THE QUEEN, on the occasion of her Coronation, has been graciously pleased to confer the following honours and awards :—

ORDER OF THE BATH

Knight Grand Cross.—Air Chief Marshal Sir Hugh W. L. Saunders, K.C.B., K.B.E., M.C., D.F.C., M.M.

Knights Commanders.—Air Marshal Sir Francis J. Fogarty, K.B.E., C.B., D.F.C., A.F.C. Air Marshal Sir Ronald Ivelaw-Chapman, K.B.E., C.B., D.F.C., A.F.C.

Companions.—A.V-M. G. D. Harvey, C.B.E., D.F.C., A.V-M. W. H. Merton, O.B.E., A. Cdre. A. D. Davies, C.B.E., A. Cdre. H. D. McGregor, C.B.E., D.S.O. A. Cdre. J. Marson, C.B.E., A. Cdre. T. B. Prickman, C.B.E., G/C. D. J. P. Lee, C.B.E. G/C. J. G. Davis, O.B.E., B.A.

ORDER OF THE BRITISH EMPIRE

Knight Grand Cross.—Air Chief Marshal Sir Hugh Pughe Lloyd, K.C.B., K.B.E., M.C., D.F.C., L.L.D.

Knights Commanders.—Air Marshal R. O. Jones, C.B., A.F.C., B.A., D.I.C., Act. Air Marshal J. MacC. Kilpatrick, C.B., O.B.E., M.B., B.Ch., Q.H.P.

Commanders.—The Rev. A. S. Giles, O.B.E., M.A., Q.H.C., A. Cdre. F. E. Fredrick Elvy Lipscomb, M.R.C.S., L.R.C.P., Q.H.P., A. Cdre. P. B. L. Potter, O.B.E., M.D., Ch.B. Act. A. Cdre. W. E. Oulton, D.S.O., D.F.C. Act. A. Cdre. W. A. Stagg, O.B.E., Group Captains C. E. J. Baines, V. G. A. Bennett, L. Crocker, A.F.R.Ae.S., E. M. Donaldson, D.S.O., A.F.C., N. C. Hyde, G. L. S. Griffith-Jones, M.A., R. S. Ryan, E. J. H. Starling, J. A. C. Stratton, O.B.E.

Officers.—Act. G/C. R. A. C. Barclay, A.F.C., The Rev. G. W. N. Groves, Wing Commanders R. C. Cobbe, D.S.O., A. E. Davies, G. H. Everitt, D.S.O., D.F.C., R. T. Frogley, D.F.C., J. E. Holliwell, M.B.E., E. A. Jackson, D. R. S. Bevan-John, N. A. Martin, W. G. Oldbury, D.F.C., A. Richardson, D. D. Rogers, W. Smith, G. Tate, D.F.C., C. D. Tomalin, D.F.C., A.F.C., Act. Wing Commander M. S. Anthony, R.Aux.A.F., Squadron Leaders I. R. Blair, G. Castle, F. Ellison, A.F.C., J. E. Lewis, L. A. Popham, A. Weaver, Act. Squadron Leader E. Robinson, Rab Khaila Z. Gewergis, M.B.E., R.A.F. Levies, Iraq.

Members.—Squadron Leaders A. J. L. Craig, D.S.O., D.F.C., A.F.C., H. E. Hunt, R.A.F. Reg., D. T. M. Lumsden, C. K. Street, Act. Squadron Leaders S. Gilchrist. R. C. Instrell, D.F.C., S. James, C. T. N. Moore, R.A.F. Reg., R. J. Reid, R.A.F.V.R., Act. Squadron Officer M. H. Shaw, W.R.A.F., Flight Lieutenants W. S. Brokenshire, A. Contaris, A.F.C., J. C. Cottam, R. P. Hall, E. W. Hassall, J. D. Jolly, M.A, H. F. V. Marshall, R. Parsons, S. W. Pattinson, H. C. Robinson, G. W. Scott, A.F.C., R.Aux.A.F., R. W. Sparkes, D.F.C., R. A. Targett, C. J. Turner, G. E. Veasey, Act. Flight Lieutenant H. W. Gibbons, R.A.F.V.R., Flying Officer W. L. Lawrenson, Warrant Officers W. S. Carlile, R. Dixon, W. E. Elkins, A. H. Hamilton, R. J. Hole, S. E. Humphries, J. H. Large, S. Lee, A. J. Lewis, F. G. Marsh, P. J. O'Reilly, L. Sanderson, E. T. Southorn, C. H. Stanley, Act. Warrant Officer T. Dawson.

IN FULL REGALIA: Marshals of the Royal Air Force Lord Trenchard, Lord Tedder and Lord Douglas in procession from Dean's Yard to Westminster Abbey during a Coronation rehearsal.

AWARDS

Bar to Air Force Cross.—Squadron Leaders J. Lomas, D.F.C., A.F.C., L. G. Press, A.F.C., Flight Lieutenant N. C. Thorne, A.F.C.

Air Force Cross.—Wing Commander G. H. N. Shiells, D.F.C., R.A.A.F., Act. Wing Commander K. Bazarnik, M.B., Ch.B., Squadron Leaders J. H. Smith-Carington, L. H. Casson, D.F.C., R.Aux.A.F., H. M. Chinnery, L. D. Drake, D.F.C., T. Helfer, D.F.C., D. R. Howard, D.F.C., D. S. Leete, S. J. Perkins, D. H. Seaton, D.F.C., Act. Squadron Leaders J. L. Barlow, F. C. Barter, J. G. Claridge, D.F.C., D. J. Fowler, C. L. Godwin, J. Miller, D.F.C., A. A. Smailes, L. M. Whittington, Flight Lieutenants B. S. Adlington, G. B. Bell, J. B. Blackett, J. A. Brown, L. E. Burton, R. D. Campbell, D.F.C., J. H. Cermak, P. G. Coulson, H. S. Horth, T. L. Kennedy, D. Langford, J. G. Matthews, C. J. Morgan, J. Muzika, K. C. D. Nixon, T. W. Oakey, B.Sc., J. S. Owen, J. D. Price, K. B. Rogers, D.F.C., M. R. Sisley, M. C. N. Smart, C. M. Stavert, G. Stephenson, D.F.C., C. D. Thieme, A. P. Trowbridge, G. V. Wadams, K. A. Whynacht, D.F.C., J. R. Wilcock, R. T. G. Williams, R.Aux.A.F., D. Wright, Flying Officers I. Cardwell, M. A. J. St. Pierre, J. P. Skirka, Master Pilot G. H. Owen, A.F.M., Lieutenant Commander C. E. Price, R.N. Lieutenants F. Cawood, R.N., T. G. Innes, R.N., R. W. Jaggard, R.N.

Royal Red Cross (First Class).—Wing Officer E. M. Marfleet, A.R.R.C., P.M.R.A.F.N.S.

Royal Red Cross (Second Class).—Flight Officers O. C. Rees, P.M.R.A.F.N.S., A. L. G. Robertson, P.M.R.A.F.N.S.

(To be continued)

Coastal Command Trophy

FOR the year 1952-53, the Coastal Command Trophy has been won by No. 201 Squadron (Short Sunderlands). In the absence of the commanding officer, S/L. R. A. N. McCready, the trophy was handed

SERVICE AVIATION . . .

to the adjutant by Air Chief Marshal Sir Frederick Bowhill (A.O.C in-C. Coastal Command from 1937 to 1941) at the reunion dinner held at Coastal Command headquarters on May 16th.

The dinner was attended by more than 200 past and present Coastal Command officers, including Marshal of the Royal Air Force Lord Douglas, Air Chief Marshal Sir Philip Joubert, Air Chief Marshal Sir John W. Baker and the present A.O.C-in-C., Air Marshal Sir Alick Stevens.

The trophy, which is awarded for general training efficiency, was presented by the Coastal Command Officers' Reunion.

Fleet Air Arm Appointments

THE Admiralty has announced the following appointments: Capt. R. H. Wright to command H.M.S. *Triumph*, Capt. A. F. Black, D.S.C., to command R.N. Air Station Yeovilton, and Capt. T. W. B. Shaw, D.S.C., to R.N. Air Station Londonderry.

"Ocean" Awards

A NUMBER of decorations to officers and ratings of H.M.S. *Ocean* were recently announced in the *London Gazette*. The awards are for service in the carrier during her first tour of duty in Korean waters.

Capt. C. L. G. Evans, D.S.O., D.S.C., who commanded the ship, has been appointed C.B.E. and, for exceptional service as a pilot and squadron commander, Cdr. C. K. Roberts receives the D.S.O. Three other pilots are awarded the D.S.C. They are: Lt. P. S. Davis, who flew a total of 183 offensive sorties; Lt. P. Carmichael, who led the division which shot down the first Mig-15 to be destroyed by piston-engined aircraft; and Lt. Hawkesworth, who flew 153 offensive sorties.

Appointed M.B.E. are Lt. Cdr. R. A. J. Lea, flight deck officer, and Lt. Cdr. (E) P. L. Luby, air engineer officer. Two aircrewmen, C. P. McCullagh and J. P. Potter, receive the D.S.M.

Scone Trophy

FOR the first time since it was instituted in 1951, the Scone Trophy has been won by the Aberdeen University Air Squadron. Scores were: Aberdeen, 427 points; St. Andrews, 390; Glasgow, 379; and Edinburgh (the holders), 360. The commanding officer of the winning squadron is S/L. J. R. Forsythe.

WITH THE AMERICANS: W/C. J. D. Lindsay of the Royal Canadian Air Force, who has been awarded the U.S. D.F.C. for his operational flying while attached to the U.S.A.F. in Korea.

Showing the Flag

FIGHTER aircraft of the R.A.F. component of 2nd A.T.A.F., based in Germany, are to take part in air displays in Spain, Switzerland, France and the Netherlands during the summer.

The aerobatic team of four Venoms of No. 11 Squadron were due to perform at Madrid on May 30th and will also give a show at the Swiss air display at Kloten on August 28th and 29th.

On June 14th, No. 94 Squadron's aerobatic team of four Vampires will be at Toulouse-Blagnag in France and another Vampire team, probably from No. 26 Squadron, will be at Le Bourget, Paris, for the two-day display on July 4th and 5th.

Later in July, on the 18th, two squadrons each of Sabres and Venoms will take part in the big fly-past planned for the Dutch air display at Soesterberg. For this display, also, No. 266 (Rhodesia) Squadron, back from the Rhodes Centenary celebrations at Salisbury, is sending an aerobatic Venom, and the Command may provide a Sabre, Venom, Vampire, and Meteor N.F.11 for the static display.

No. 266 Squadron is also sending a Venom to give an aerobatic show at the Lyons-Bron display in France on August 2nd.

Aides-de-Camp

THE *London Gazette* of May 5th announced the following change in appointment as Aides-de-Camp to the Queen: A. Cdre. R. C. Mead, who had previously filled a group captain's post as A.D.C., to continue as an aide-de-camp in his new rank. New appointments are: G/C. B. K. Burnett, G/C. D. S. Radford, G/C. E. D. M. Nelson, G/C. G. C. Eveleigh and G/C. A. C. Kermode.

Lee-on-Solent "At Home"

VISITORS to the "At Home" at R.N. Air Station Lee-on-Solent, Hampshire, on Saturday June 13th, will have a preview of the mass fly-past of Naval aircraft due to take place at the Coronation Fleet Review on the following Monday. Nearly 200 aircraft will be taking off from 1630 hr and these, after joining up with 60 more from Ford and a further 50 from Culham, will pass over the anchored fleet.

There will be no charge for admission to the display, but profits from car-parking charges, pleasure flights and the sale of programmes will go to Naval charities. No car-park movement will be allowed between 1600 hr and 1900 hr, the period set aside for the take-offs and landings of the fly-past aircraft.

Seats at the Reviews

NAVAL and Royal Marine holders of the Victoria Cross or George Cross, who wish to attend the Coronation Naval Review on June 15th will be accommodated in some of the ships. Applications should be made to the Admiralty, Military Branch (Review Section).

The Air Ministry invites applications from retired regular officers of the R.A.F. and W.R.A.F., retired officers and members of P.M.R.A.F.N.S., and ex-regular airmen (in receipt of long-service pensions), for free tickets to attend the R.A.F. Coronation Review at Odiham, Hampshire, on Wednesday, July 15th. Applications should be made to the Under Secretary of State (S.4 (d)), Air Ministry, Whitehall Gardens, London, S.W.1, and marked "Coronation Review of the R.A.F." The applicant's number and rank, should be included, as well as the number of tickets required and whether a car park label is wanted. Applications should, if possible, be made before June 8th.

WITH THE AUSTRALIANS: F/L. Whitworth-Jones—son of Air Chief Marshal Sir John Whitworth-Jones—who has completed a tour of duty with No. 77 Squadron, R.A.A.F., in Korea. He flew on 157 operational sorties.

Members of the Auxiliary and Reserve air forces (with an annual training liability) who wish to attend should seek instructions from their commanding officers.

R.A.F.A. Annual Conference

APPROXIMATELY 1,000 ex-R.A.F. men and women will be attending the annual conference of the Royal Air Forces Association, to be held in Bournemouth on June 13th and 14th. Marshal of the Royal Air Force Lord Tedder will be in the chair.

On Sunday morning, June 14th, at 0900 hr, there will be a parade at the war memorial; branch standards will be carried and Lord Tedder will lay a wreath.

R.A.F. Medical Appointments

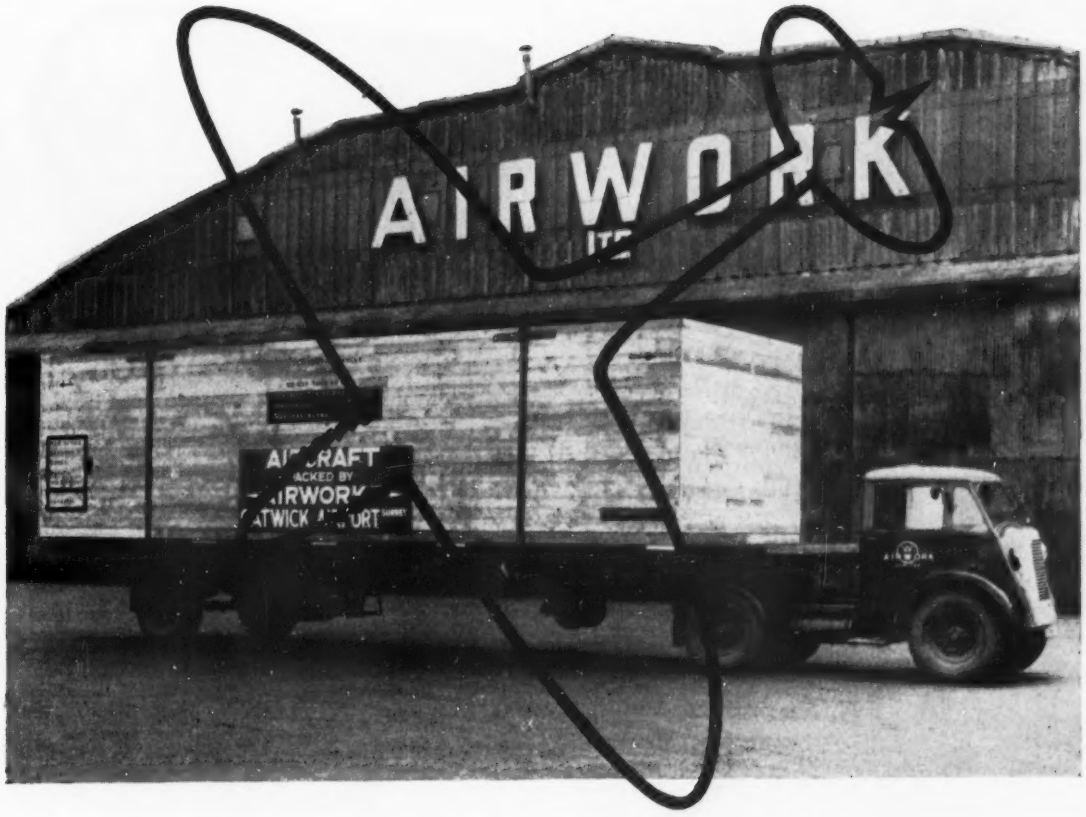
THE Air Ministry has announced that A.V-M. V. S. Ewing, C.B.E., is to be Principal Medical Officer, Home Command, with effect from July 1st. His place as P.M.O. with M.E.A.F. will be taken by A. Cdre. R. H. Stanbridge, O.B.E., Q.H.P., who will take the acting rank of air vice-marshal. A. Cdre. Stanbridge has been P.M.O. of Bomber Command for the past three years.

East Coast Flood Awards

FOR their services in connection with the severe flooding of air stations following the inundation of parts of the East Coast of Britain early this year, the following have received the Queen's Commendation for Brave Conduct: W/C. V. Winn, D.S.O., O.B.E., D.F.C., P/O. P. J. Graham, P/O. J. T. Greenwood, P/O. T. C. Purling, B.Sc., L. A/C. W. J. J. Goodman, L. A/C. W. A. Kirkland, L. A/C. D. W. Martin and A/C.2 K. Summerscales.

Signals Officers Exchange

DIRECTOR of Signals of the Royal New Zealand Air Force, W/C. R. J. Gibbs, O.B.E., has undertaken two years' exchange duties to study the latest developments in R.A.F. telecommunications, radar and navigational aids. His post in New Zealand will be held by W/C. R. McIlwaine, from the R.A.F. Central Signals Establishment.



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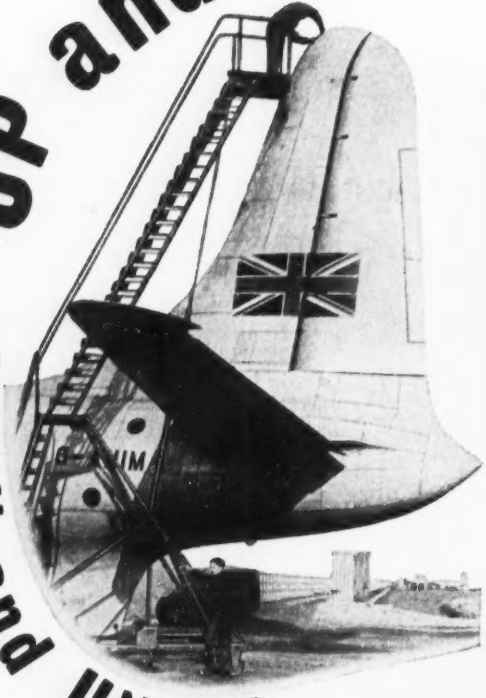

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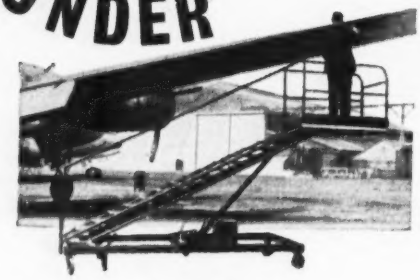

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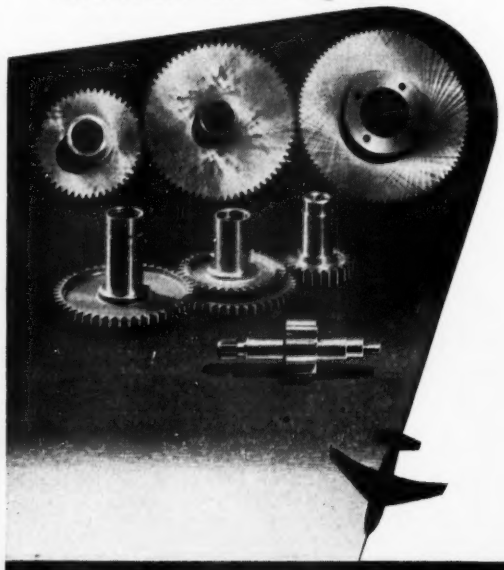

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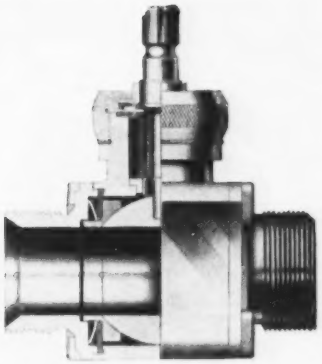

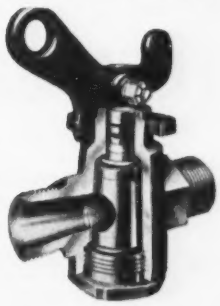

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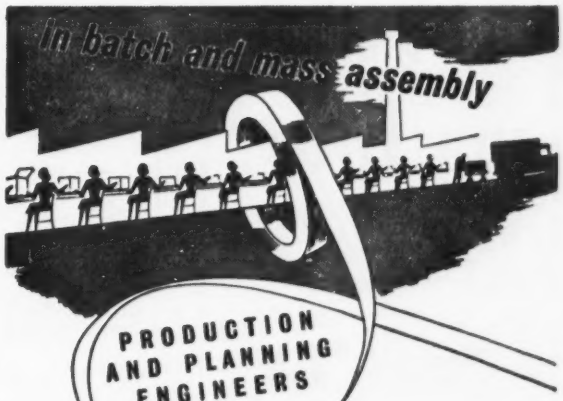

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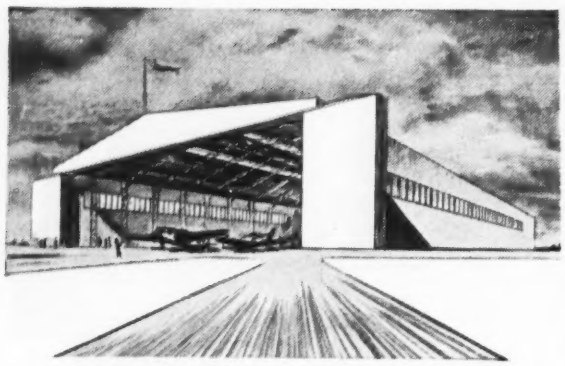

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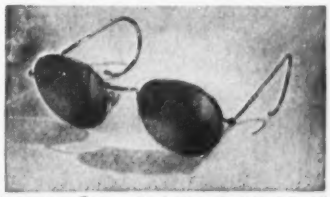

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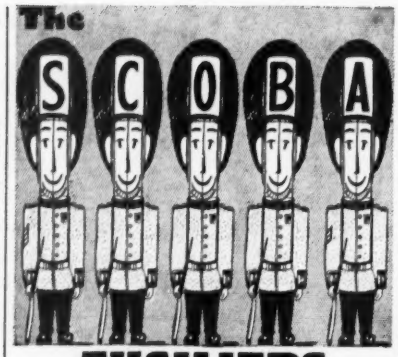

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THIS application will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to this application must be made in writing, stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 9 Buckingham Gate, London, S.W.1, from whom further details of the application may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, must reach them within the period allowed for the making of representations or objections. [9696

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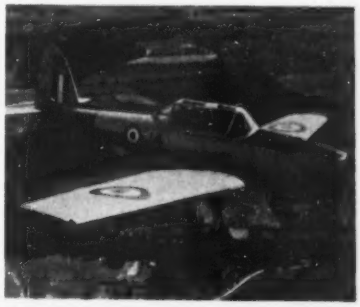

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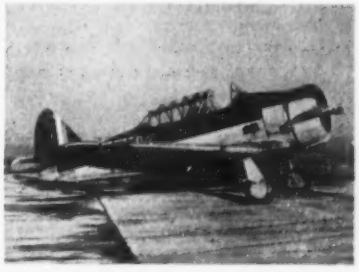

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SITUATIONS VACANT

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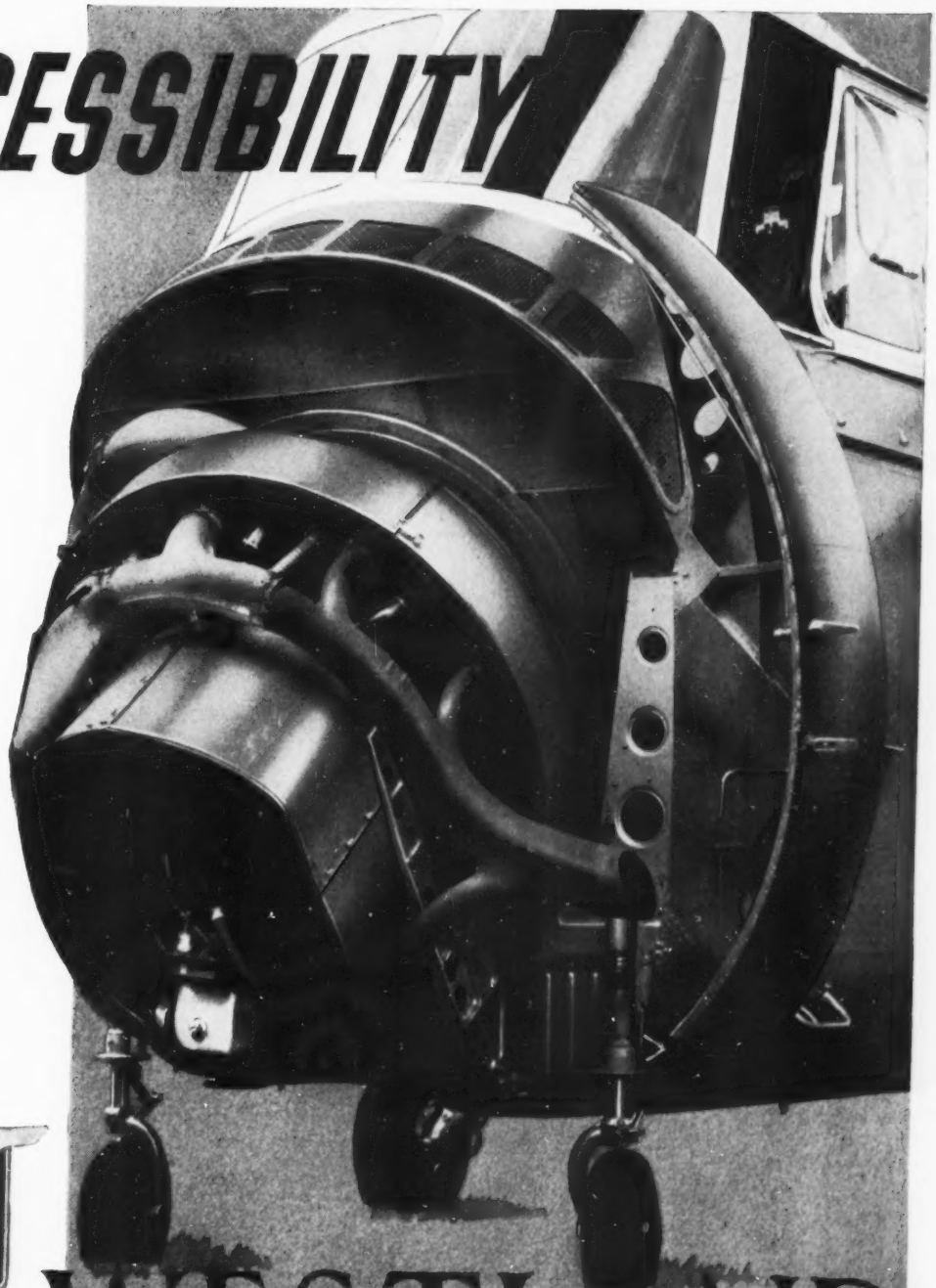

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